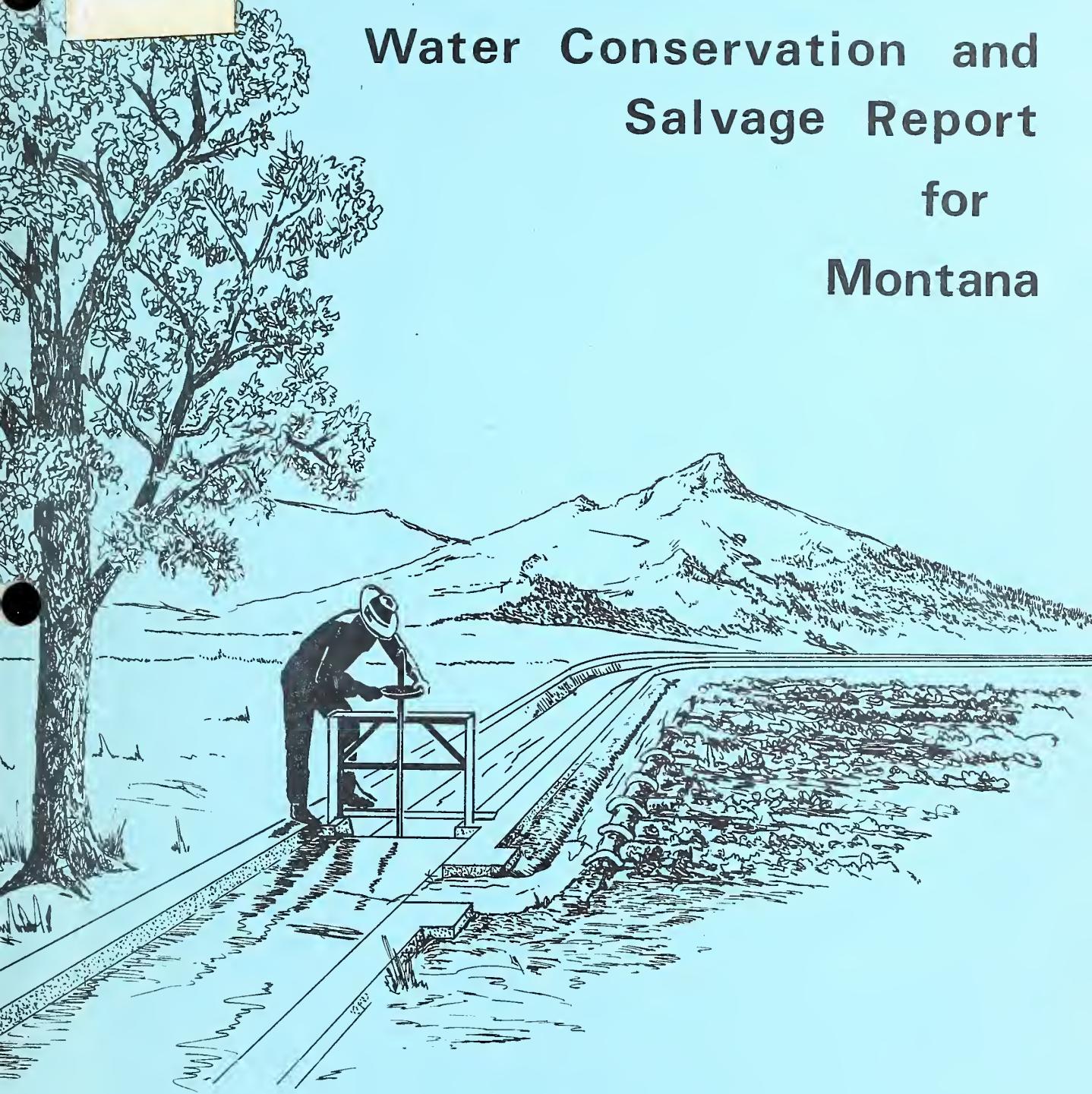


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Water Conservation and Salvage Report for Montana



Prepared by

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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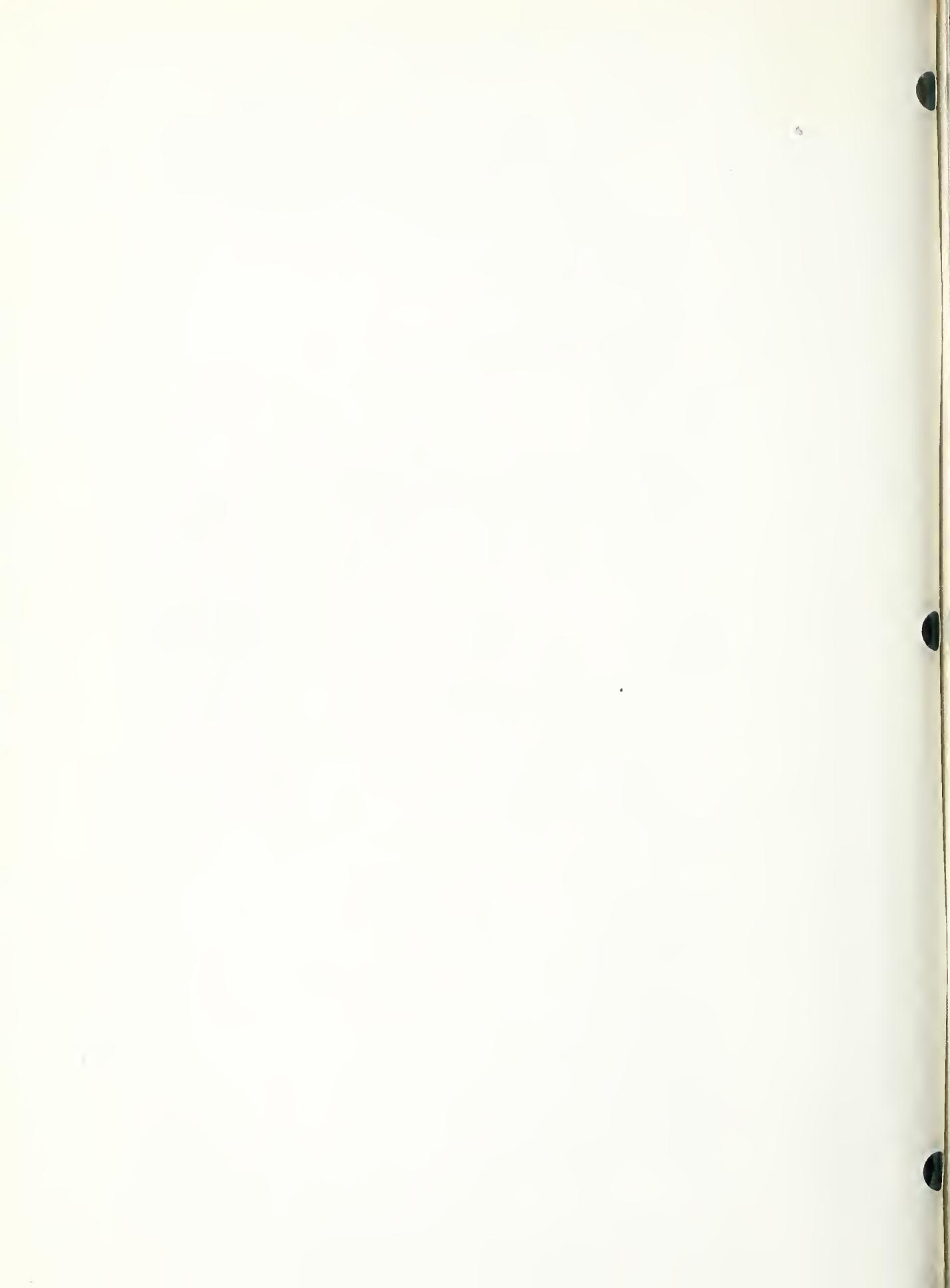
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UNITED STATES DEPARTMENT OF AGRICULTURE
U.S. Soil Conservation Service /
River Basin and Watershed Planning Staff
Bozeman, Montana

1976



INTRODUCTION

The Soil Conservation Service estimated the potential for water conservation and salvage on irrigated lands in Montana as a part of the Western United States Water Plan.

This study was to determine impacts that irrigation water conservation and salvage would have on irrigated agriculture in Montana on a county basis. Inventories and evaluations were conducted of existing irrigation systems, their efficiencies, and levels of management to estimate the opportunities for improving water conservation. The potential was also evaluated for improving existing irrigation systems and their management. Estimates of costs to install these improvements were made. Impacts of these improvements on water use efficiency, water supply, water quality, and crop production were estimated.

Complete determination of the potential for water salvage requires that information be collected on location, acreage, and acre-feet of water used by riparian and natural phreatophytes on nonirrigated areas and of incidental losses in irrigated areas. Due to limited potential for treatment of these natural phreatophyte areas and lack of available acreage information in Montana, these data were not developed.

Results of this study evaluating the potential for water conservation should be useful to water resource decision-makers in Montana.

PROCEDURE

The study was conducted under the direction of the SCS River Basin Planning Staff. An engineer was assigned in each of six SCS areas in Montana to work with District Conservationists to tabulate existing,

needed, and potential water conservation measures and to develop present and future water and salt budgets for each county in Montana. Available data such as SCS "99" reports, Conservation Needs Inventory, Census of Agriculture, river basin reports, State of Montana reports, and county reports were used. Reliance was given to experience and knowledge of SCS field office staffs whenever better data were unavailable. Field estimates were used to develop much of the data for this report due to a lack of existing data. It is expected that this report will provide a foundation for future studies. Narrative summaries and conclusions were prepared for each county.

County data were checked, tabulated, and summarized by hydrologic regions and totaled for Montana. These data, with descriptions of the irrigated base and potential of water conservation and its impacts, constitute the report.

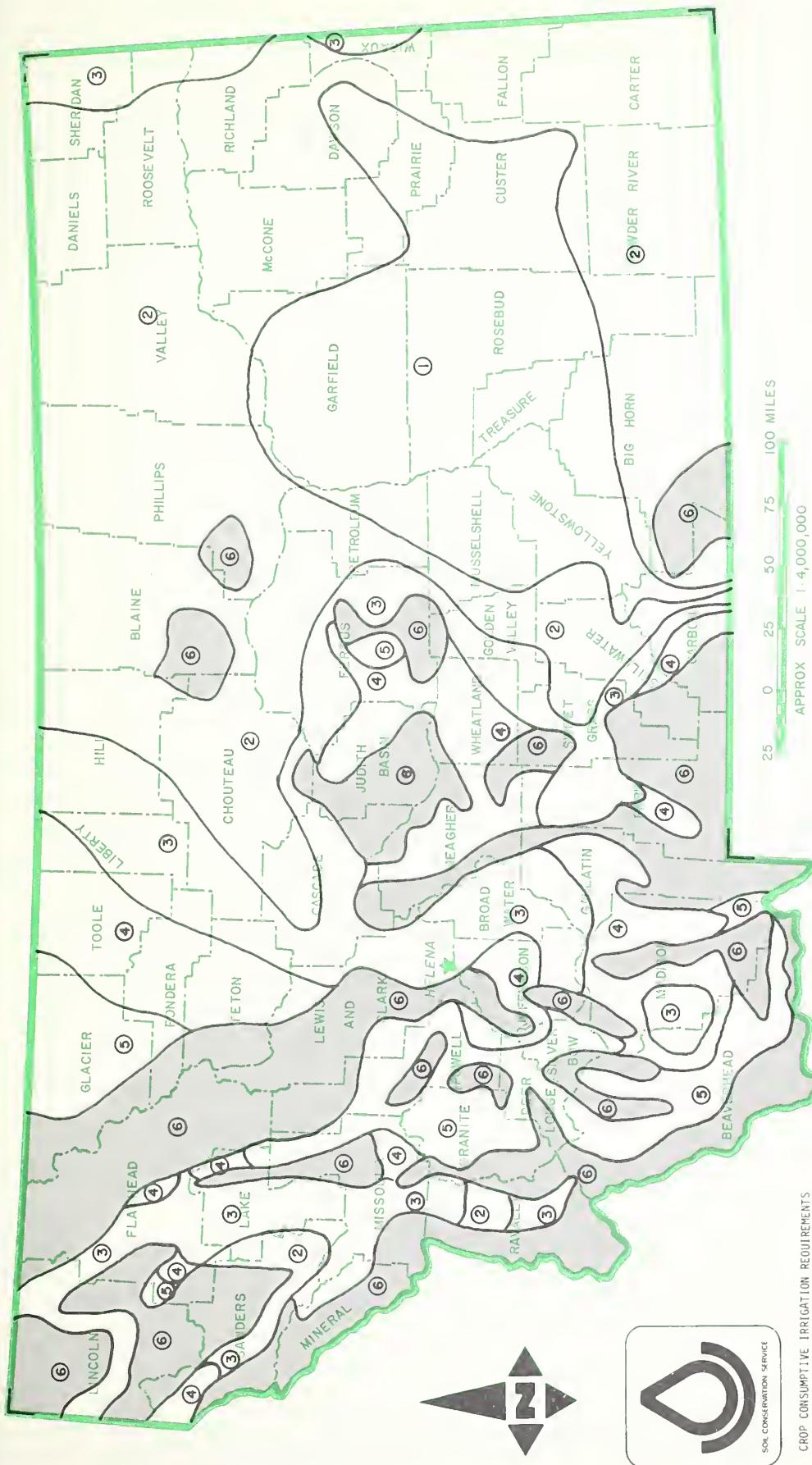
Although waterspreading is not usually included with irrigation, it has been included in this study. Waterspreading constitutes a limited application of water to land, but can be a very productive practice. Water is diverted from intermittent streams for irrigation of adjacent lands. Water is generally available only for short periods of time with one irrigation or less expected in a normal year.

Three maps have been included in this report--Montana's Subbasins, Montana's Irrigated Acres, and Montana Crop Consumptive Irrigation Requirements.

The Map of Crop Consumptive Irrigation Requirements was developed using the SCS Irrigation Guide For Montana and is based on 50 percent chance effective rainfall to determine annual requirements. This map was used to estimate irrigation water requirements.

MONTANA CROP CONSUMPTIVE IRRIGATION REQUIREMENTS

MONTANA



CROP CONSUMPTIVE IRRIGATION REQUIREMENTS
(acre-feet per acre)
based on 50% chance effective rainfall



	Alfalfa (dry)	Beans (dry)	Beets (sugar)	Corn (silage)	Corn (sweet)	Grain (Spring)	Grain (Winter)	Grass	Orchard (dec.)	Pears	Potatoes
①	1.8	1.1	1.6	1.3	1.2	1.1	0.8	1.6		1.0	1.6
②	1.6	1.1	1.5	1.1	1.1	1.0	0.7	1.4		0.9	1.5
③	1.5	0.9	1.3	0.9	1.0	0.9	0.7	1.3		1.5	0.8
④	1.2		1.1	0.8	0.8	0.9	0.6	1.1		1.2	1.1
⑤	0.9			0.7		0.6		0.9			

- generally not irrigated and is mountainous. (shaded areas)



IRRIGATION IN THE STATE OF MONTANA

Irrigated agriculture in Montana dates back to the early 1840's. The first agriculture was practiced in 1842 by Father DeSmet at St. Mary's Mission near Fort Owen in what is now Ravalli County. The first irrigation was on gardens of this mission. The first water right officially filed in Montana was for lands around Fort Owen in 1852.

Early settlers in Montana obtained land under provisions of the Homestead Law of 1862 and the Desert Land Act of 1877. The former act gave 160 acres of land to anyone who settled on it and put it in cultivation. The latter gave 640 acres of land to anyone who would irrigate it and pay the government \$1.25 per acre. In 1890, filings under the Desert Land Act were reduced to 320 acres. Construction of ditches on desert claims was in compliance for title to land, rather than for irrigation, and little attention was paid to the water supply available. Consequently, miles of ditches were dug through which no water ever flowed. This is especially true in drier parts of Montana where diversions were made from intermittent streams.

In the more fertile mountain valleys, irrigation was given more importance than in the plains country. Live streams provided a dependable source of water and ditches which tapped them were designed to actually carry water--not merely to comply with a legal requirement to obtain title to land. Thus, the right to diversion and use of water for irrigation became as important as acquisition of title to the land.

Because of low annual precipitation in the lower agricultural valleys of the west and eastern plains areas, irrigation is very essential to a viable agriculture in Montana. Dryland farming prospered in the early 1900's under

MONTANA



● 10,000 Acres Irrigated

WPP-SCS 1970

conditions of abnormal rainfall and high prices, but is generally limited to small grain and fallow today. Most of the other crops grown in Montana are raised under irrigation. The importance of irrigation to produce hay for winter feed for livestock was brought home early during the severe winter of 1886-87. Because of lack of winter feed and protection from cold, 60 percent of the range cattle were said to have been lost.

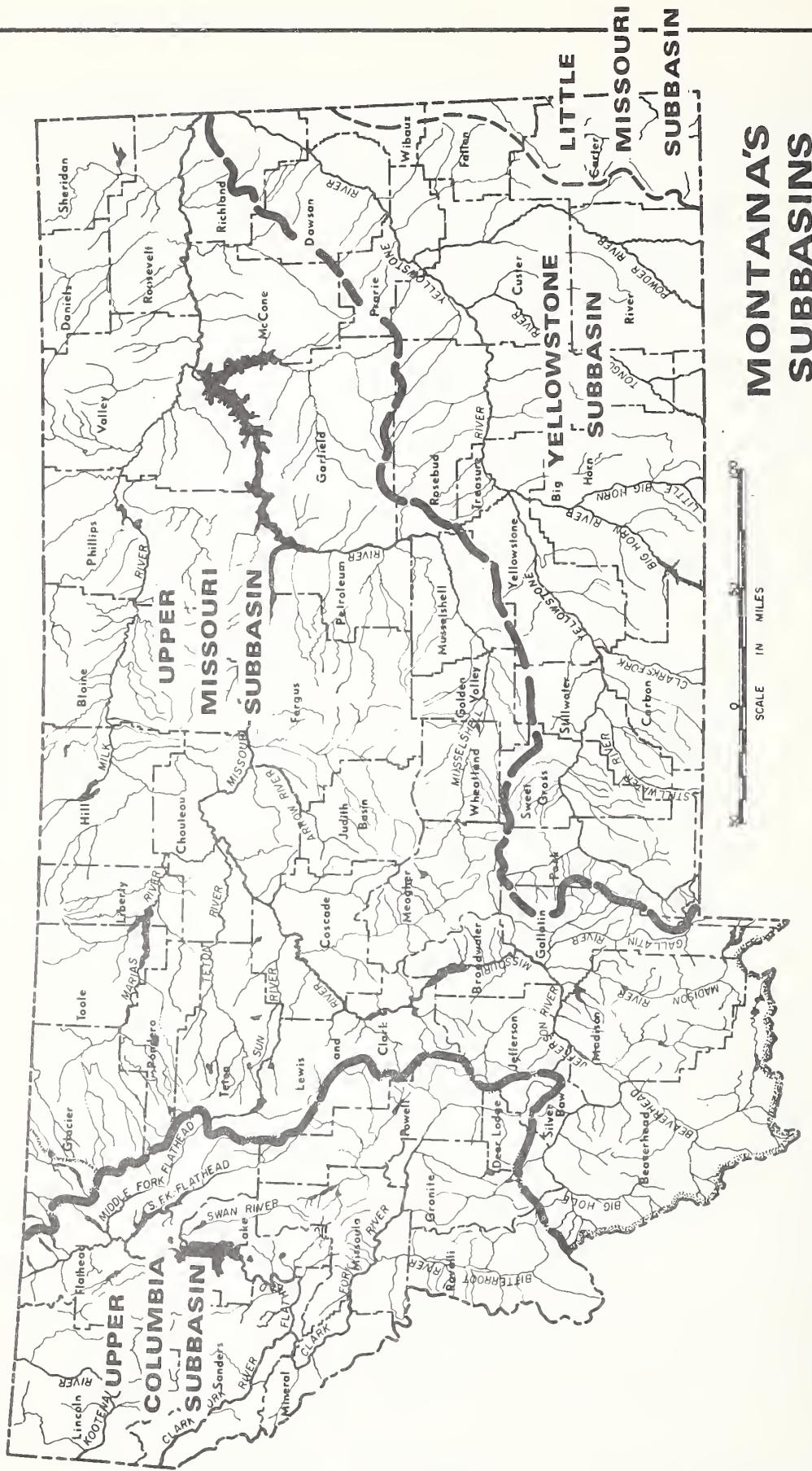
Montana has nearly 66 million acres of range, pasture, and grazable woodland or about 71 percent of the 93 million acres of land area. About 18 percent of the land area or 17.2 million acres are cropland. Cropland acreages are broken down as follows:

	<u>Million Acres</u>
Dry cropland	13.3
Dry tame pasture	1.3
Irrigated cropland	1.8
Irrigated pasture	0.5
Waterspreading	0.3

About 79 percent of the 2.6 million acres of irrigated land is in irrigated hay and pasture producing forage for Montana's livestock. Irrigated hayland produces 62 percent of the hay harvested in Montana. This hay is vital to stability of the livestock industry and maintenance of the rangeland resource. Other irrigated crops include small grains, corn silage, sugar beets, and beans.

Cash sales of agricultural products in Montana in 1969 were nearly 576 million dollars, with an average of about \$23,100 per farm. Livestock sales accounted for 67 percent of total sales. There were 24,953 farms in Montana in 1969 according to the Census of Agriculture. Over 9,000 of these farms have some irrigated land.

MONTANA



Irrigated agriculture is still growing in Montana. Most of the irrigable land that can be easily reached by gravity diversion has been developed. The Montana Department of Natural Resources and Conservation has mapped an additional 11.5 million acres of land that could be irrigated if a supply of water were physically and economically available. See table 1.

This study deals only with lands that are irrigated today. All new irrigation is expected to meet or surpass the projected year 2000 efficiencies.

The state was divided into four hydrologic areas or subbasins for this study: the Upper Columbia, Little Missouri, Yellowstone, and Upper Missouri. The Upper Missouri includes the area that drains into the Hudson Bay. In subsequent discussion of the subbasins, the Little Missouri is included with the Yellowstone Subbasin.

Montana has large quantities of water for irrigation. Annual water production in Montana averages over 35 million acre-feet. There is an inflow from Wyoming and Canada of another 13 million acre-feet. See table II. Even with this abundant quantity of water, the state is over two million acre-feet short of meeting today's diversion requirements of 15 million acre-feet. See table III-a. Mountain snowpack is the primary source of Montana's water. Streamflows diminish during the summer and late season shortages occur, especially on smaller streams. More storage reservoirs are needed to supplement late season needs along with more efficient irrigation systems. Anticipated construction of late season storage and improved irrigation systems could reduce this shortage to about 600,000 acre-feet by year 2000. See table III-b. Most of the remaining shortage will be on waterspreading systems in the state. Areas where waterspreading is practiced are generally low water-

producing areas and there is very little opportunity to provide a full supply. Wherever a full water supply is developed for waterspreading, the lands are reclassified as irrigated.

Only 34 percent of the irrigated lands have adequate off-farm conveyance systems. For this study, conveyance systems were considered adequate when they were capable of delivering an adequate supply with a reasonable efficiency. Today's conveyance systems deliver only one-half of the diverted water to the farms due to conveyance losses. Canal consolidation, canal lining, new measuring devices, and other water control structures could improve conveyance efficiency to 66 percent by year 2000. See tables IV-a and V-a.

Nearly one-half of the irrigated lands need improved off-farm return systems to provide outlets for surface and drainage waters. The other lands either have natural or adequately constructed outlets. Improved conveyance and on-farm systems and better water management would reduce the need for drainage outlets. Another 1,740 miles of main drains and waterways should be added to the existing 2,650 miles by year 2000 to provide additional drainage outlets. Ecological and environmental restraints and availability of replacement lands reduce the opportunity to provide adequate return systems. It is anticipated that many of the wet and seeped lands will remain. Improved conveyance and on-farm irrigation systems and better water management would halt further development of seeped lands.

Only one-quarter of the irrigated lands in Montana have adequate on-farm irrigation systems, and only one-half of these obtain good irrigation water management. There is great need to improve on-farm systems and irrigation water management. Conversion to sprinkler and automated surface irrigation

systems, along with an intensive training program in water management, offer the best opportunities to improve on-farm irrigation water use. Only five inches of every twelve inches of water delivered to the farm are being used by crops. This is expected to increase to about six and one-half inches of every twelve by year 2000. See table IV-b and V-b.

Today only one irrigated acre in ten has an adequate water supply, conveyance system, on-farm system, and return system and receives good irrigation water management. Today about 4.9 acre-feet are diverted for every acre-foot used by crops. By year 2000 only 2.9 acre-feet are expected to be diverted for each acre-foot used by crops. This improvement in efficiencies, irrigation water management, and additional late season storage would provide an adequate water supply to most of the existing irrigated lands with the exception of waterspreading systems. See tables VI-a and VI-b.

Improved irrigation systems would also reduce salinity of irrigation return flows. Today, irrigation may be responsible for about 10 percent of the salt load in waters leaving the state. The anticipated improvements should lower irrigation's contribution to about two percent. See table VII.

The treatment opportunities listed in table V include only needs that have a "real" opportunity of being met by year 2000. Present-day costs of these improvements are estimated at nearly three-quarters of a billion dollars or about \$275 per acre. See table VIII.

Impacts of increased supply, more efficient conveyance systems, and improved on-farm irrigation systems and management are substantial and include:

1. Providing a 94 percent adequate supply to existing irrigated acres in Montana.

2. An annual decrease in withdrawals or diversions of over four million acre-feet.
3. An annual decrease in seepage of over 3-1/2 million acre-feet.
4. An annual decrease in salt pickup of nearly 1-1/2 million tons.
5. Improving or reclaiming wet and seeped lands and arresting their development.
6. A substantial increase in productivity of irrigated land due to better water supply, improved management, and higher-valued crops.

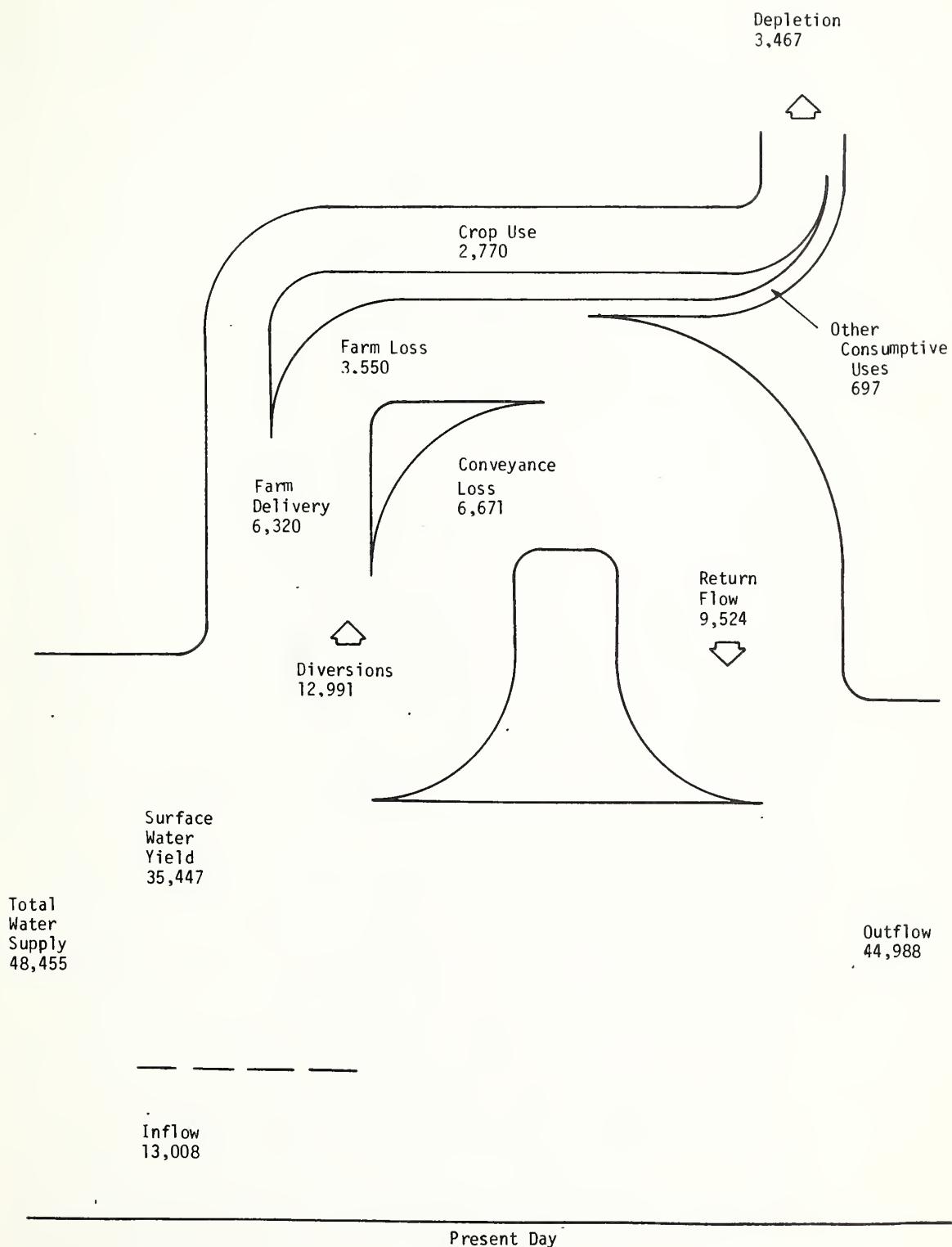
Figures I-a and I-b, Irrigation Water Budgets for today and year 2000, show the effect that improvement of irrigation practices would have on the water resource of Montana. A significant decrease is noted in gross diversions and conveyance and farm losses while an increase is expected in crop use and total depletion resulting in little or no change in water outflow from Montana.

Rates of application of conservation practices would have to be accelerated in order to accomplish needs by year 2000. Nearly 30 million dollars would have to be spent annually as compared with about 16 million dollars spent for all soil and water conservation work in Montana during fiscal year 1973. An intensive water management education program is needed to meet projected on-farm irrigation efficiencies by year 2000.

UPPER COLUMBIA SUBBASIN OF MONTANA

The Upper Columbia Subbasin is that portion of Montana west of the Continental Divide. Most of it is drained by the Clark Fork of the Columbia river system, including the Bitterroot, Blackfoot, and Flathead Rivers. The extreme northwest corner is drained by the Kootenai River entering Montana

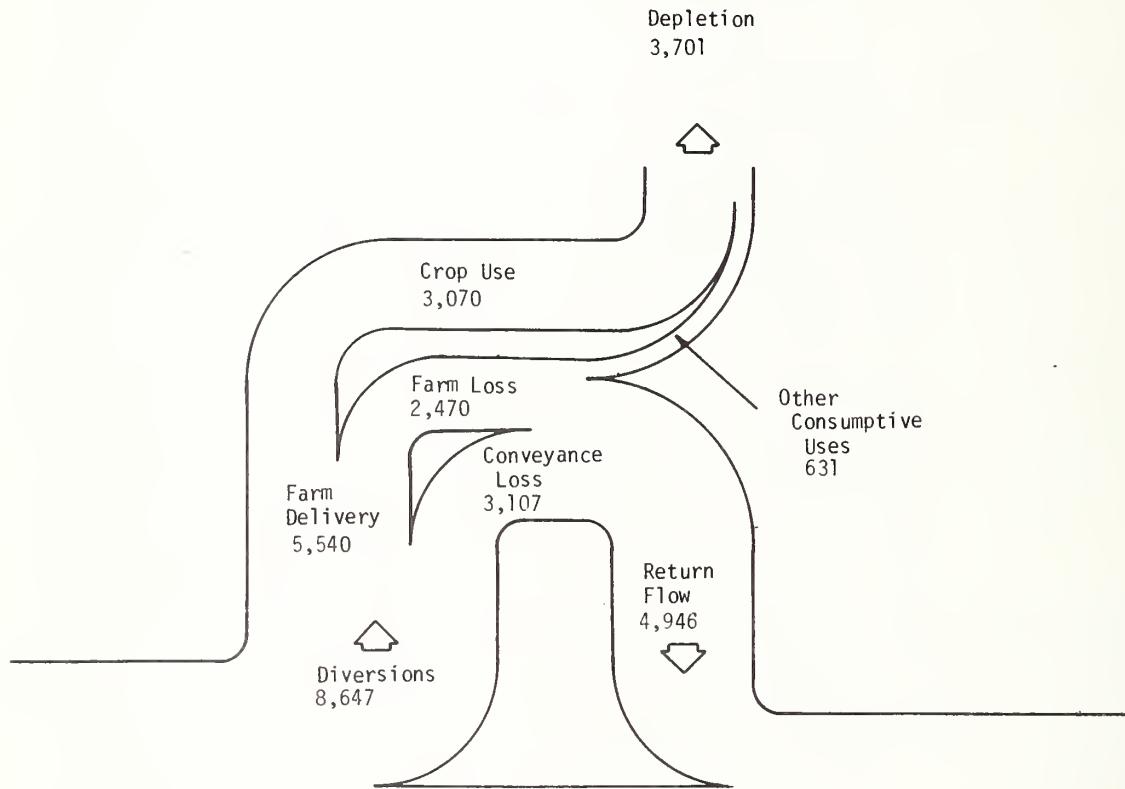
FIGURE Ia
IRRIGATION WATER BUDGET
STATE OF MONTANA
(thousand acre-feet)



Present Day

FIGURE Ib
IRRIGATION WATER BUDGET

STATE OF MONTANA
(thousand acre-feet)



Total Water Supply 48,455 Surface Water Yield 35,447
Inflow 13,008 Outflow 44,754

Year 2000 -

from Canada. Both the Clark Fork of the Columbia and Kootenai Rivers flow into Idaho.

The subbasin is an area of diverse topography. The primary land forms are mountain ranges separated by countless streams. A green forest mantle covers the mountains while farms and ranches occupy rather narrow valley areas.

The climate is greatly influenced by elevation and topographic features. Summers are typically warm with little rainfall, while winter temperatures average below freezing for long periods. Windward sections of the high mountains will receive as much as 100 inches of precipitation annually, while those areas in the rain shadows seldom get more than 10 inches. Low valley lands along the rivers generally average from 10 to 20 inches of precipitation annually.

The major source of water for this subbasin is snow which falls in the higher forested mountain areas. Practically all the high mountain ranges contribute from 30 to 50 inches of runoff annually. The valley and foothill areas generally receive so little precipitation that their contribution to streamflow is negligible. About 17,970,000 acre-feet of water are produced annually in this subbasin, which is about 50 percent of the surface water yield of Montana. Another 6,159,000 acre-feet flow into the subbasin from Canada. See table II.

There are about 16,097,000 acres in the Upper Columbia Subbasin with only 2.3 percent or 438,700 acres irrigated. Irrigated pasture (28 percent) and hay (57 percent) are the major irrigated crops. Irrigated hay production accounts for 78 percent of the hay produced in the subbasin. There are 4,025 farms in the subbasin with 62 percent having irrigated land. In 1969, the total value of agricultural products sold was 48 million dollars for an average of \$11,800 per farm.

Gross diversion of streamflow for irrigation is about 1,539,000 acre-feet or 8.6 percent of the water produced in the subbasin. Irrigation and associated uses consume only 528,000 acre-feet or 2.9 percent of the 17,970,000 acre-feet of water produced in the subbasin. Even with the great abundance of water, 262,000 acres (60 percent of the irrigated land) have a supply shortage of 484,000 acre-feet at the point of diversion. See table III-a. Most of the mountain snowpack, the source of irrigation water, usually has melted by the end of June, resulting in late summer water shortages, especially on smaller streams. Irrigation reservoir storage of 244,000 acre-feet has been built to supplement late season irrigation needs. Another 110,000 acre-feet of reservoir storage for late season use is expected to be constructed by year 2000. This storage along with additional diversions and pumping from larger streams, ground-water developments, and improved efficiencies, would reduce the water supply shortage to about 98,000 acre-feet. See table III-b. Most of this remaining shortage will exist on the Flathead Irrigation Project in Lake County. Any remaining shortages in this area could be pumped from the Flathead River, but this is not expected due to high pump lift and associated costs.

There are approximately 4,500 miles of canals and laterals in off-farm conveyance systems of this basin. About 42 percent of the irrigated land has an adequate conveyance system. Only 1.6 percent of existing canals and laterals have been lined or placed in pipelines. Only 55 percent of the water diverted is delivered to the farm, which means 697,000 acre-feet are lost by off-farm conveyance systems. See table IV-a.

The installation of 395 miles of canal consolidation, 204 miles of canal lining, and 6,025 canal structures is needed by year 2000. This would improve the off-farm conveyance system efficiency to 61 percent. See table V-a.

Only 18 percent of presently irrigated land has an inadequate return system. Generally, land slope and natural drainage are adequate to handle excess natural and irrigation waste waters. Another 290 miles of new main drains should be added to the existing 460 miles of off-farm drains. See table V-a.

Approximately 38 percent or 166,900 acres of the 438,700 irrigated acres have adequate on-farm irrigation systems with only 26 percent or 115,100 acres having good irrigation water management. See table IV-b. Only 49 percent of the water delivered to the farm is being used by crops. Extensive conversion from surface flood irrigation to sprinkler irrigation is improving on-farm irrigation efficiency. Sprinkler irrigation is being used on 143,400 acres or 33 percent of the irrigated lands today. The amount of sprinkler irrigation is expected to double by year 2000. See table V-b. The conversion to sprinkler and other on-farm improvements, along with better irrigation water management, would improve on-farm efficiency to about 55 percent by year 2000. The overall combined irrigation efficiency of 27 percent today could be improved to 34 percent by year 2000 by installation of water-conserving practices and better management. Present-day costs of these improvements are estimated at 98 million dollars or about \$223 per acre. See table VIII.

Effects of increased supply, more efficient conveyance systems, and improved on-farm irrigation systems and management include:

1. Providing a 94 percent adequate supply to presently irrigated acres--an increase from a 76 percent supply.
2. An annual decrease in withdrawals of about 32,000 acre-feet.
3. An annual decrease in seepage of 120,000 acre-feet.
4. An annual decrease in salt pickup of 36,000 tons.

5. Improving or reclaiming wet and seeped lands and arresting their development.
6. Substantially increased yields due to adequate supply and improved management.

Figure II compares the present-day irrigation water budget with year 2000 showing the effect of irrigation improvements. The major effect in this sub-basin is a substantial increase in crop use without an increase in diversion. Note that crop use is a minor amount of the overall water supply of the sub-basin.

Rates of application for improvements of off-farm conveyance systems would have to be accelerated in order to accomplish needs by year 2000. Sprinkler irrigation acreage would have to be more than doubled and an intensive water management education program is needed to meet projected on-farm irrigation efficiencies by year 2000.

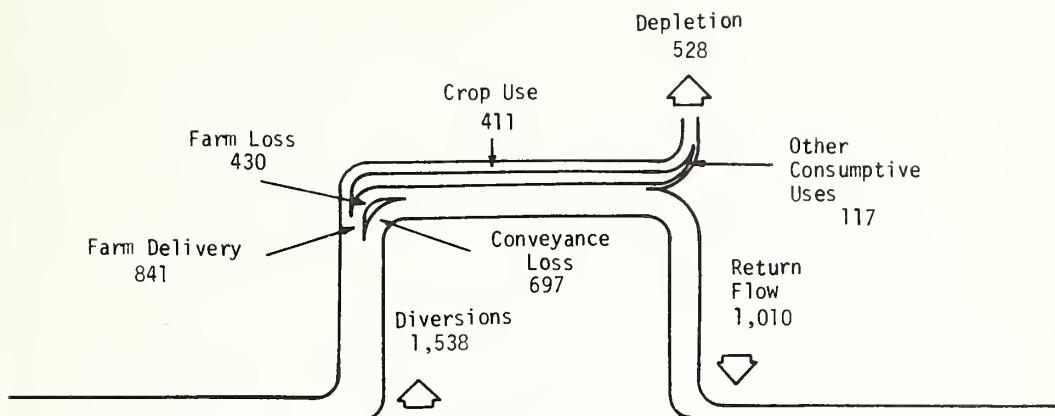
UPPER MISSOURI SUBBASIN

The Upper Missouri Subbasin is that portion of Montana draining into the Missouri River above the confluence with the Yellowstone River and is a part of the Missouri River system. A small portion of Montana that drains into the Hudson Bay is included with the Upper Missouri Subbasin for purposes of this study.

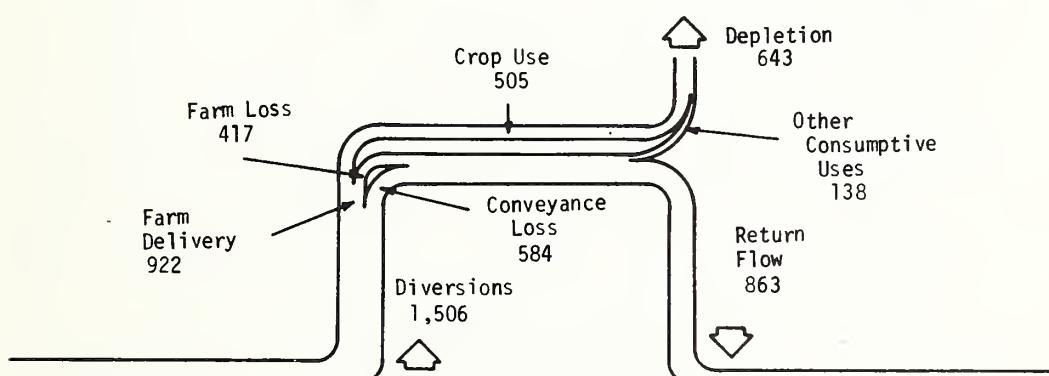
The Jefferson, Gallatin, and Madison Rivers in southwestern Montana are the headwaters of this subbasin. The confluence of these three rivers is the beginning of the Missouri River. Other major rivers in this subbasin include the Sun, Marias, Judith, Musselshell, and Milk Rivers.

FIGURE II

IRRIGATION WATER BUDGET
COLUMBIA SUBBASIN
(thousand acre-feet)



	<u>Present Day</u>
Total Water Supply	24,129
Surface Water Yield	17,970
Outflow	23,601
Inflow	6,159



	<u>Year 2000</u>
Total Water Supply	24,129
Surface Water Yield	17,970
Outflow	23,486
Inflow	6,159

The two major physiographic areas which characterize this subbasin are the western mountainous region and the Missouri plateau. The Rocky Mountains and Continental Divide form the western boundary. The western region is characterized by alternating prominent mountain ranges, intermountain basins, and relatively wide valleys. Minor tributaries have steep gradients, and channels generally are "V"-shaped. The streams flow through steep canyons before they reach more level topography of the plains where stream gradients lessen. The mountainous region slopes eastward to the Missouri Plateau of the interior plains. The northern portion of the plateau is glaciated and is a broad expanse of gently rolling topography. Stream dissection and drainage are not well established except along larger tributaries. The southern portion is unglaciated and is rolling and rather thoroughly dissected by streams. The mountains in the subbasin are forested, while the plains are grass covered interspersed with wheat fields. Irrigated crops are generally limited to valley lands.

Several factors influence the climate of this subbasin. Cold waves flow south out of the Canadian interior frequently during the winter. The rapid descent of relatively warm air from high mountains on the west, causing a "chinook" wind, often gives quick and substantial relief from periods of cold. The subbasin position on the North American land mass results in relatively warm temperatures in summer and low temperatures in winter. The plains rarely receive more than 14 inches of moisture annually, mostly as rainfall between April and August, while the higher mountains receive as much as 100 inches annually.

The Upper Missouri Subbasin receives most of its waters from snowpack in the mountains. The valley, foothill, and plains areas contribute very little

to streamflow. About 11,221,000 acre-feet of water in the Upper Missouri Subbasin and 1,204,000 acre-feet in the Hudson Bay Subbasin are produced annually for a total of 12,425,000 acre-feet. See table II.

There are about 53,121,000 acres in the Upper Missouri and Hudson Bay Subbasins, with 2.8 percent or 1,472,500 acres under irrigation. Irrigated pasture (22 percent) and hay (64 percent) are the major irrigated crops. Nearly 62 percent of the hay produced is harvested from irrigated land. In 1969 there were 13,763 farms in the subbasins with 30 percent having irrigated land. The agricultural product sales from irrigated farms amounted to about 342 million dollars with a per farm average of \$24,800.

The gross diversion of streamflow for irrigation is about 7,149,000 acre-feet or 58 percent of the surface water yield. Water consumed by irrigation and associated uses is only 15 percent of the annual yield. Of one and one-half million acres irrigated, 44 percent or 650,000 acres need another 1,101,000 acre-feet of water supply at the diversion. See table III-a. Nearly 189,000 of these acres are classified as waterspreading. Most of the other supply-short acres are irrigated from smaller streams that are short of water after the snowmelt season. Over 1,330,000 acre-feet of reservoir storage has been constructed to supplement late season needs. Another 542,000 acre-feet of storage is needed by year 2000. This added storage, along with additional diversions and pumping from larger streams, groundwater development, and more efficient irrigation will reduce the shortage to 284,000 acre-feet annually. See table III-b. Most of the remaining shortage will be for waterspreading systems where opportunities for storage usually do not exist.

Over 10,700 miles of canals and laterals are used to convey irrigation water to the farms. About 30 percent of the irrigated lands have off-farm

conveyance systems that are adequate. About one percent of off-farm conveyance systems are lined or in pipe. Only 48 percent or 3,481,000 acre-feet of the water diverted reaches the farms. The rest is lost through seepage or operational losses. See table IV-a. About 1,020 miles of canal consolidation, 1,240 miles of canal lining, and 13,000 new irrigation structures are needed to improve conveyance efficiency to 62 percent by year 2000. See table V-a.

Off-farm return system improvement is needed for 72 percent of the irrigated lands. Installation of 990 miles of waterways and drains are expected by year 2000. See table V-a. Reduction of canal seepage and on-farm losses will play an important part in solving the problem.

About 309,000 acres have adequate on-farm irrigation systems, while only 132,000 acres are receiving good irrigation water management. See table IV-b. Only 41 percent of the water delivered to the farm is utilized by crops. In order to increase this efficiency to 56 percent by year 2000, about 1,530 miles of pipelines and canal lining, 105,000 acres of land leveling, 58,500 new structures, 365,000 acres of sprinkler, and 57,000 acres of automated surface irrigation would have to be installed. An additional 763,000 acres of irrigation water management is also needed to obtain this goal. See table V-b.

Nearly \$378,000,000 or about \$257 per acre would have to be expended to install all the improvements. See table VIII.

Many benefits of additional late season supply, more efficient conveyance and on-farm irrigation systems, and better irrigation water management include:

1. Providing an adequate supply most years to all irrigated acres except waterspreading systems.
2. Reducing water withdrawals from streams by over two and one-half million acre-feet annually.

3. An annual reduction of seepage exceeding two million acre-feet.
4. Reduction in salt pickup from the land by 678,000 tons annually.
5. Reclamation of many wet and seeped lands and halting further development of seeped lands.
6. Increased production of higher-valued crops and increased yields.

Figure III, the irrigation water budget for the present and year 2000, shows the effect irrigation improvement would have on the water resource of the subbasin. A substantial reduction is noted in gross diversions and conveyance and farm losses.

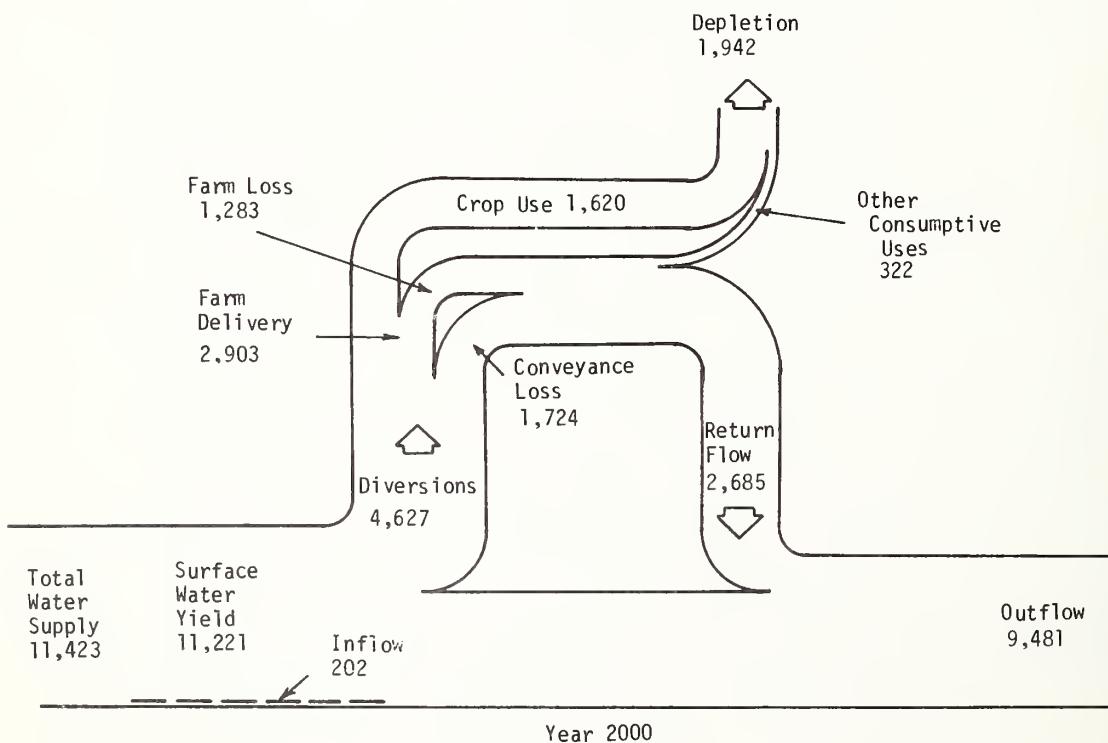
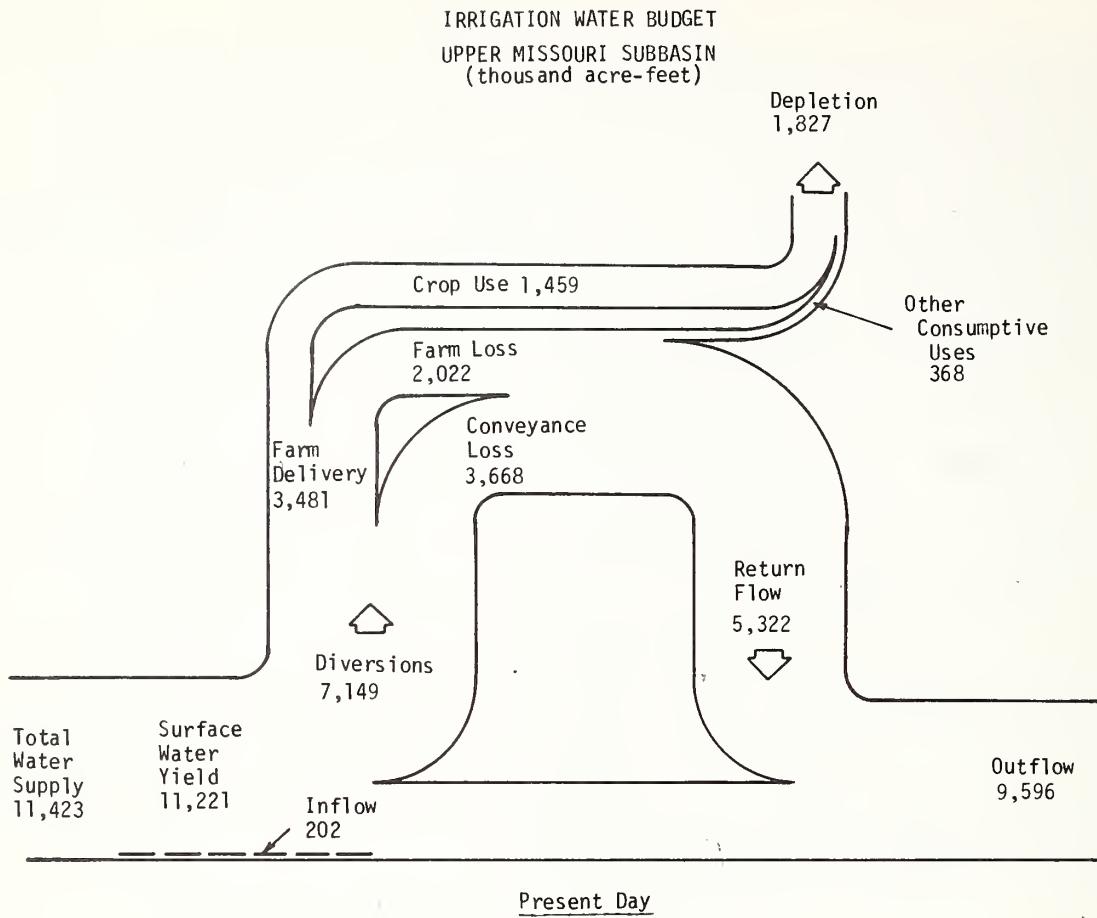
Improvement of off-farm conveyance systems would have to be accelerated to meet the year 2000 goal. Conversion to sprinkler irrigation would have to be accelerated many times. An intensive water management training program is essential to obtain projected improvements.

YELLOWSTONE RIVER SUBBASIN

The Yellowstone River Subbasin is that part of the Missouri River Basin drained by the Yellowstone River and its tributaries. About one-half of the Yellowstone River drainage is in Montana and one-half is in Wyoming. Its northern boundary in Montana runs roughly from the northwest corner of Wyoming to the northeast corner of Montana. A small portion of southeastern Montana drained by the Little Missouri River is included with the Yellowstone River Subbasin for purposes of this study.

The Yellowstone River heads in the mountains of Wyoming just south of Yellowstone National Park and flows north through the park into Montana. In Montana it turns northeasterly and flows along the northern boundary of the subbasin to its confluence with the Missouri River near the Montana-North Dakota state line. The major tributaries all enter the Yellowstone River

FIGURE III



from the south and include the Clarks Fork of the Yellowstone, Bighorn, Tongue, and Powder Rivers.

The two major physiographic areas which characterize this subbasin are the mountainous western portion and Missouri Plateau. The western portion contains part of the Rocky Mountain system and is characterized by high mountains separated by countless streams and valleys descending to the Yellowstone River valley and plains to the east. The larger part of the subbasin is characterized by a broad expanse of rolling topography dissected by intermittent streams of the unglaciated Missouri Plateau of the Great Plains. The mountains are forested while the plains are grass covered interspersed with some wheat fields. Irrigated crops are generally limited to valley lands.

The climate of the Yellowstone River Subbasin is one of wide variations in temperature and precipitation. Average annual temperatures vary by as much as 48°F within the subbasin with extremes ranging from 100°F above to 40°F below. Average annual precipitation ranges from 70 inches in the mountains to 12 to 14 inches in the eastern prairies. One area along the Clarks Fork of the Yellowstone River near the Wyoming state line receives only 5 to 7 inches.

This subbasin receives most of its water yield from snowpack in the high mountains. The plains areas contribute very little to streamflow. Over one-half of the supply in the Yellowstone River is produced in Wyoming. Of the 35,447,000 acre-feet of surface water yield in Montana, about 14 percent or 5,052,000 acre-feet are produced in the subbasin. Another 6,647,000 acre-feet enter Montana from Wyoming. These figures include the yield of the Little Missouri drainage. See table II.

There are about 25,164,000 acres in the Yellowstone River Subbasin, including the Little Missouri, with about 2.9 percent or 731,800 acres under

irrigation. Irrigated pasture (19 percent) and hay (44 percent) are the major crops. Irrigated hay production accounts for 53 percent of the hay produced in the subbasin. There are about 7,162 farms in the subbasin, of which about 3,000 have some irrigated land. The sales of agricultural products in 1969 amounted to \$185,670,000 with an average of \$25,900 per farm.

Gross diversion of streamflow for irrigation is about 4,303,000 acre-feet, which is about 85 percent of the subbasin water yield produced in Montana. Irrigation and associated uses consume only 1,112,000 acre-feet or 22 percent of the Montana yield. Of 731,800 acres irrigated, 224,600 acres are short 426,000 acre-feet at the diversion. See table III-a. These acres include 158,300 acres that are classified as waterspreading; most of the other 66,300 acres are supplied by smaller streams that are short of water after the snowmelt season. About 171,000 acre-feet of irrigation storage has been built to provide late season supply. Another 59,000 acre-feet of reservoir storage are needed for late season use by year 2000. Added storage along with additional diversions and pumping from larger streams, ground-water development, and improved irrigation efficiencies would reduce shortages to 215,000 acre-feet by year 2000. See table III-b. Most water-spreading systems do not have opportunities for improved supply.

Off-farm conveyance systems contain nearly 4,500 miles of canals and laterals used to carry water to the farms. About 39 percent of the conveyance systems are adequate to serve farms irrigated from them. Less than one percent of the canals and laterals are lined. About 1,997,000 acre-feet or 46 percent of the water diverted is delivered by off-farm conveyance systems. See table IV-a. Improvements consisting of 820 miles of canal consolidation, 1,630 miles of lining, and 8,300 new irrigation structures are expected by year 2000. This would improve conveyance system efficiency to about 71 percent. See table V-a.

Off-farm return systems are not adequate for 32 percent of the irrigated land. New or improved return systems are needed to provide outlets for seeped areas and natural and irrigation waste waters. About 460 miles of waterways and drains need to be installed by year 2000. See table V-a. Reduced canal seepage and improved on-farm efficiency would arrest development of seeped lands and help improve them.

About 33 percent or 244,700 acres have adequate on-farm irrigation systems, while only 13 percent or 93,800 acres have good irrigation water management. See table IV-b. About 47 percent of the water delivered to the farm is being used by crops. By year 2000 on-farm efficiency is expected to be 57 percent as the result of installing 1,350 miles of canal lining or pipelines, leveling another 88,600 acres, installing over 54,400 new irrigation structures, converting 102,000 acres to sprinkler, automating 141,000 acres, and obtaining good irrigation water management on 294,000 acres. See table V-b.

Present-day costs of anticipated improvements are estimated at \$251,000,000 for an average of \$342 per irrigated acre. See table VI-11.

Effects of additional late season supply, more efficient conveyance systems, and improved on-farm irrigation systems and water management include:

1. An adequate irrigation water supply to irrigated lands most years with the exception of waterspreading systems.
2. A reduction in withdrawals of about 1,760,000 acre-feet annually.
3. A reduction in annual seepage losses of about 1,300,000 acre-feet.
4. Reduction of salt-loading of streams by nearly 660,000 tons annually.
5. Arresting development of wet and seeped lands and reclaiming many of them.
6. Substantially increased yields and raising of higher valued crops due to adequate water supply and better management.

Figure IV compares the present-day irrigation water budget with that of year 2000.

Rates of application of improvements of off-farm conveyance systems would have to be accelerated to accomplish needs by year 2000. Development of automated surface irrigation is necessary to obtain projected improvement of on-farm irrigation efficiencies along with an intensive educational program in irrigation water management.

FIGURE IV

IRRIGATION WATER BUDGET

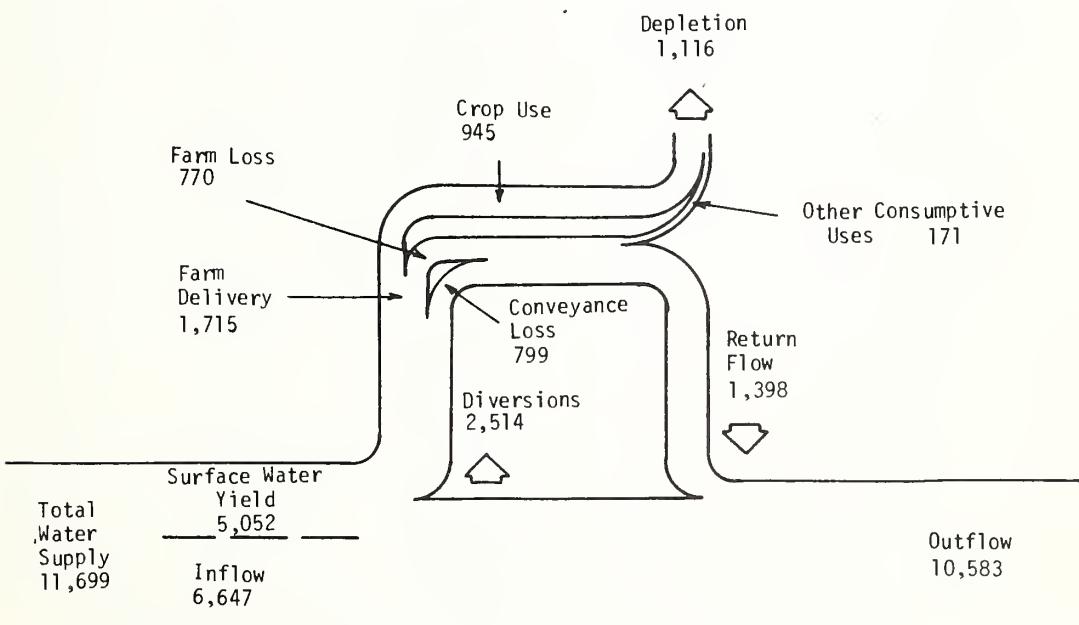
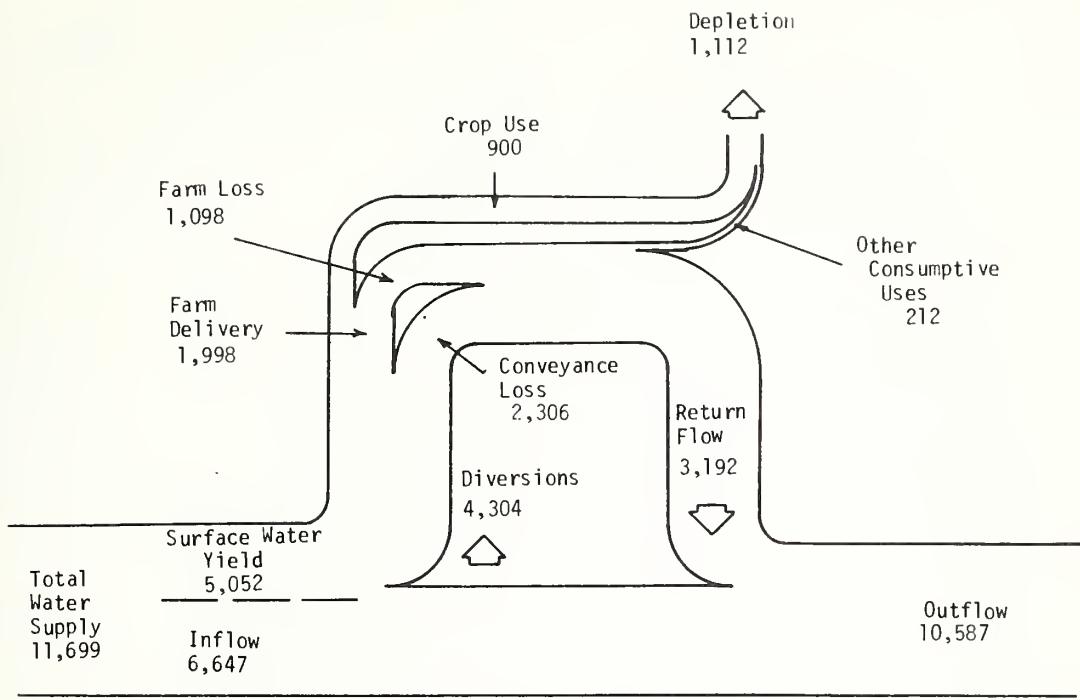
YELLOWSTONE SUBBASIN
(thousand acre-feet)

TABLE I

IRRIGABLE LAND IN MONTANA 1/

COUNTY	CLASS 1	CLASS 2	CLASS 3	CLASS 3C	TOTAL IRRIGABLE
	:	:	:	:	:
Beaverhead	: 9,469	25,194	239,494	7,826	281,983
Big Horn	: 10,548	178,049	121,079	0	309,676
Blaine	: 0	97,120	111,380	0	208,500
Broadwater	: 561	24,294	120,192	0	145,047
Carbon	: 512	19,849	52,021	0	72,382
Carter	: 293	4,559	79,768	0	84,620
Cascade	: 26,453	69,877	112,799	0	209,129
Chouteau	: 0	7,474	566,112	0	573,586
Custer	: 2,115	30,769	55,455	0	88,339
Daniels	: 930	41,761	282,147	0	324,838
Dawson	: 4,841	181,750	322,281	0	508,872
Deer Lodge	: 0	16,879	52,284	0	69,163
Fallon	: 123	5,725	69,945	0	75,793
Fergus	: 632	190,431	236,855	6,152	434,070
Flathead	: 27,531	43,548	217,488	0	288,567
Gallatin	: 1,135	52,232	176,201	3,380	232,948
Garfield	: 0	18,457	34,034	0	52,491
Glacier	: 67,383	113,592	228,901	52,796	462,672
Golden Valley	: 282	8,053	105,149	0	113,484
Granite	: 0	207	62,076	0	62,283
Hill	: 0	5,614	745,949	0	751,563
Jefferson	: 0	10,225	75,463	1,042	86,730
Judith Basin	: 4,182	201,850	150,079	0	356,111
Lake	: 0	10,632	168,859	0	179,491
Lewis and Clark	: 0	6,778	92,825	6,801	106,404
Liberty	: 1,120	92,212	321,962	0	415,294
Lincoln	: 3,397	14,106	146,530	3,850	167,883
Madison	: 670	49,590	167,501	6,068	223,829
McCone	: 212	23,635	64,975	0	88,822
Meagher	: 0	48,582	52,654	624	101,860
Mineral	: 0	783	21,607	0	22,390
Missoula	: 0	7,485	159,066	5,002	171,553
Musselshell	: 1,315	9,677	82,116	0	93,108
Park	: 0	28,299	69,787	9	98,095
Petroleum	: 0	9,326	22,073	0	31,399
Phillips	: 7,023	5,772	190,389	0	203,184
Pondera	: 152	12,023	157,661	0	169,836
Powder River	: 60,839	237,858	96,735	0	395,432
Powell	: 950	25,392	85,144	10,866	122,352
Prairie	: 1,157	41,267	49,227	0	91,651
Ravalli	: 0	11,324	46,417	414	58,155
Richland	: 1,348	37,304	155,127	0	193,779
Roosevelt	: 1,555	32,435	358,009	0	391,999
Rosebud	: 3,732	94,302	31,234	0	129,268
Sanders	: 0	7,186	174,978	0	182,164

TABLE I

IRRIGABLE LAND IN MONTANA (Continued)

COUNTY	CLASS 1	CLASS 2	CLASS 3	CLASS 3C	TOTAL IRRIGABLE
Sheridan	47,992	248,044	136,683	0	432,719
Silver Bow	0	10,824	55,606	0	66,430
Stillwater	0	2,473	17,065	0	19,538
Sweet Grass	0	40,006	61,073	0	101,079
Teton	7,579	78,581	98,244	1,163	185,567
Toole	325	5,377	199,132	0	204,834
Treasure	11,518	46,111	24,875	0	82,504
Valley	1,017	95,227	238,622	0	334,866
Wheatland	101	84,599	197,223	9,383	291,306
Wibaux	9,476	38,120	37,702	0	85,298
Yellowstone	9,959	137,194	86,201	0	233,354
STATE TOTAL	328,427	2,940,033	8,084,454	115,376	11,468,290

Source: Montana Department of Natural Resources and Conservation

1/ The land classification system for determining irrigable land used by the Montana Department of Natural Resources and Conservation separates the land areas into (1) lands having potential for irrigation termed "irrigable" in contrast to (2) the inferior "nonirrigable" lands which are unsuited for present or future irrigation because of unfavorable characteristics. The term "irrigable land" as used in this classification, includes land with soils, topography and drainage features that are suitable for irrigation by gravity or sprinkler methods. Lands classed as "irrigable" have soil, topography and climate that will support sustained irrigated agriculture. Availability of water is not a factor in this survey.

Lands which are classified as "irrigable" are divided into classes on the basis of their relative suitability for irrigation farming. Class 1 represents irrigable land with potentially high productive value; class 2 represents land of intermediate value; and class 3 includes land of the lowest value that may be considered suitable for irrigation.

The following tables II through VIII are summaries of county data grouped by river subbasins for the state of Montana.

TABLE II--WATER SUPPLY AND USE

Subbasin	Supply			Present Depletions			Year 2000 Depletions		
	Surface Water Yield	Inflow and Import	Ground Water (Mining)	Total	Total	Irrigated Crop Use	Outflow	Total	Irrigated Crop Use
(1,000 acre-feet)									
Upper Columbia	17,970	6,159	---	24,129	528	411	23,601	643	505
Upper Missouri	11,221	202	---	11,423	1,827	1,459	9,596	1,942	1,620
Hudson Bay	1,204	0	---	1,204	0	---	1,204	0	---
Yellowstone	4,998	6,627	---	11,625	1,055	845	10,570	1,055	886
Little Missouri	54	20	---	74	57	55	17	61	59
Montana Total	35,447	13,008	---	48,455	3,467	2,770	44,988	3,701	3,070
									44,754

TABLE III-a--PRESENT IRRIGATION WATER DIVERSION REQUIREMENTS /
(Montana)

Subbasin County	Total Irrig. Land (1,000 acres)	Crop Irrigation Requirements (1,000 ft./ac.)	Conveyance System Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Overall Effi- ciency (Percent)	Total Losses (1,000 ac.-ft.)	Diver- sion (1,000 ac.-ft.)	Available for Diversions (1,000 ac.-ft.)	Supply Shortage
<u>UPPER COLUMBIA</u>									
Deer Lodge	13.7	0.87	11.9	50	23.5	42	13.6	21	37.1
Flathead	28.0	1.30	36.4	96	2.5	55	27.1	53	29.6
Granite	36.6	0.90	32.9	55	62.7	43	43.7	24	106.4
Lake	110.3	1.33	146.7	50	148.3	51	72.7	26	221.0
Lewis & Clark	2.1	0.90	1.9	50	4.5	42	2.6	21	7.1
Lincoln (subsurface)	7.4	1.34	9.9	57	13.0	53	8.1	30	21.1
Mineral	3.0	1.30	4.0	100	---	100	---	100	4.0
Missoula	35.0	1.30	45.5	62	51.6	48	43.7	30	95.3
Powell	69.4	0.94	65.2	50	126.7	42	73.5	21	200.2
Ravalli	106.8	1.34	143.1	54	206.8	51	119.0	28	325.8
Sanders	22.6	1.46	33.0	45	54.9	52	21.6	23	76.5
Silver Bow	2.4	1.16	2.8	75	1.7	45	2.8	34	4.5
Subtotal	438.7	1.22	535.1	55	696.8	49	430.1	27	1126.9
<u>UPPER MISSOURI</u>									
Beaverhead	329.0	1.10	361.9	45	941.6	42	446.8	19	1386.4
Blaine	70.0	1.51	105.7	60	166.7	40	150.0	24	316.7
Broadwater	49.7	1.30	64.6	45	167.8	44	76.9	20	244.7

TABLE III-a--PRESENT IRRIGATION WATER DIVERSION REQUIREMENTS ^{1/} (Continued)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Crop Irrigation Requirements (1,000 ft./ac.)	Conveyance System Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Farm Effi- ciency (Percent)	Overall Effi- ciency (Percent)	Farm Losses (1,000 ac.-ft.)	Total Losses (1,000 ac.-ft.)	Diversion Needed ac.-ft.)	Available for Diversion (1,000 ac.-ft.)	Supply Shortage ---
Cascade	38.9 (7.1)	1.38	53.7 (9.8)	50 (80)	107.4 (2.5)	50 (50)	53.7 (5.0)	25 (40)	161.1 (7.5)	214.8 (24.5)	---
Chouteau	7.2 (5.9)	1.51	10.9 (8.9)	50 (80)	16.5 (1.5)	45 (50)	9.1 (3.0)	22 (40)	25.6 (4.5)	48.3 (22.3)	33.0 (7.5)
Daniels	1.0 (2.3)	1.44	1.5 (3.3)	60 (90)	2.0 (0.3)	45 (65)	1.7 (0.8)	27 (58)	3.7 (1.1)	5.2 (5.7)	5.0 (2.6)
Deer Lodge	8.6	0.90	7.7	50	22.8	34	15.0	17	37.8	45.5	45.5 (3.1)
Fergus	15.0 (3.5)	1.28	19.2 (4.5)	60 (90)	31.2 (0.3)	34 (65)	30.9 (1.0)	20 (58)	62.1 (1.3)	94.1 (7.7)	78.1 (3.3)
Gallatin	93.0	1.07	99.5	50	186.6	42	108.2	21	294.8	473.9	373.1 (4.4)
Garfield	1.4 (12.0)	1.78	2.5 (21.4)	90	0.7 (90)	42	3.4 (55)	38	4.1 (50)	6.6 (43.2)	6.6 (18.2)
Glacier	17.0 (8.2)	0.85	14.5 (7.0)	42 (80)	37.8 (1.2)	40 (50)	16.4 (2.5)	17	54.2 (40)	86.0 (3.7)	65.1 (17.4)
Golden Valley	7.1 (1.5)	1.51	10.7 (2.3)	45 (80)	30.9 (0.2)	38 (50)	15.7 (0.5)	17	46.6 (40)	62.7 (0.7)	56.2 (5.7)
Hill	9.8 (9.3)	1.49	14.6 (13.9)	60 (80)	17.8 (2.3)	40 (50)	16.0 (7.2)	24	33.8 (40)	60.8 (9.5)	44.5 (34.6)
Jefferson	27.0	1.23	33.2	50	65.6	42	38.0	21	103.6	158.1	131.1 (11.6)
Judith Basin	9.0 (2.5)	1.11	10.0 (2.8)	60 (90)	22.8 (0.3)	22 (65)	26.7 (0.9)	13	49.5 (58)	75.7 (1.2)	57.0 (4.8)
Lewis & Clark	41.5	1.42	58.9	52	124.8	43	77.1	22	201.9	263.5	260.0 (2.8)
Liberty	3.3 (3.1)	1.42	4.7 (4.4)	40	12.5 (80)	50	4.2 (0.8)	20	16.7 (1.5)	23.4 (2.3)	20.9 (11.0)
Madison	140.5	1.12	157.4	42	511.0	39	225.7	16	736.7	960.7	881.0 (260.0)
McCone	4.3 (8.6)	1.53	6.6 (13.2)	83	2.3 (90)	52	5.4 (0.9)	43	7.7 (58)	15.2 (3.9)	13.6 (22.5)
Meagher	45.1	1.12	50.5	40	176.4	37	74.1	15	250.5	341.3	294.0 (341.3)
Musselshell	11.6 (0.5)	1.68	19.5 (0.8)	45	58.3 (80)	39	29.1 (0.1)	18	87.4 (40)	111.0 (0.3)	106.0 (2.1)
Petroleum	10.0 (4.0)	1.53	15.3 (6.1)	65	20.8 (90)	35	25.0 (65)	23	45.8 (58)	67.3 (1.4)	59.4 (10.5)

TABLE III-a--PRESENT IRRIGATION WATER DIVERSION REQUIREMENTS 1/ (Continued)

SUBBASIN County		Total Irrig. (1,000 acres)	Crop Irrigation Requirements (1,000 ac.-ft.)	Conveyance System Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Overall Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Total Losses (1,000 ac.-ft.)	Diver- sion : Needed for Diversions - - - (1,000 ac.-ft.)	Available Supply - - - Diversions : Shortage
Phillips		50.0	1.43	71.5	70	88.7	30	144.8	21	233.5
Pondera		(10.5)	(15.0)	(90)	(1.2)	(65)	(3.7)	(58)	(4.9)	340.5
Roosevelt		79.7	0.86	68.5	50	114.9	49	58.6	24	(25.7)
Sheridan		(44.9)	(38.6)	(80)	(11.0)	(50)	(22.0)	(40)	173.5	(11.7)
Silver Bow		9.0	1.50	13.5	60	24.5	35	23.9	21	279.8
Teton		(9.0)	(13.5)	(90)	(1.0)	(65)	(3.2)	(58)	(4.2)	(96.5)
Toole		0	1.36	---	---	---	---	---	---	(55.0)
Valley		(5.2)	(7.1)	(90)	(0.6)	(65)	(1.8)	(58)	(2.4)	(41.5)
Wheatland		4.6	0.90	4.1	60	5.5	42	4.8	25	64.3
SUBTOTAL		1284.2	1.19	1519.4	48	3633.4	41	1937.8	20	5571.2
YELLOWSTONE		(188.3)	(237.3)	(84)	(34.3)	(55)	(84.0)	(46)	(118.3)	7747.7
Big Horn		63.0	1.45	91.4	50	210.7	42	122.2	21	332.9
Carbon		(1.6)	(2.3)	(80)	(0.3)	(50)	(0.5)	(40)	(0.8)	435.0
Custer		96.4	1.40	135.0	40	506.1	40	202.4	16	(5.8)
Dawson		37.0	1.63	60.3	54	92.5	51	53.2	28	843.5
Fallon		(34.6)	(56.4)	(95)	(1.8)	(65)	(12.1)	(62)	(13.9)	843.5
Park		17.5	1.56	27.3	52	42.3	52	22.0	27	(1.3)
Powder River		(4.0)	(6.2)	(95)	(0.2)	(65)	(1.4)	(62)	(1.6)	(4.2)
		0	1.53	---	---	---	---	---	---	(4.2)
		(8.9)	(13.6)	(95)	(0.5)	(65)	(3.2)	(62)	(3.7)	(5.9)
		51.6	1.34	69.1	40	213.4	41	83.9	16	297.3
		4.9	1.52	7.5	90	1.0	52	4.2	47	(22.1)
		(21.0)	(31.9)	(90)	(2.3)	(60)	(8.4)	(54)	(10.7)	(9.6)
										355.7
										65.9
										(282.9)

TABLE III-a—PRESENT IRRIGATION WATER DIVERSION REQUIREMENTS $\frac{1}{4}$ (Continued)

SUBBASIN		Total Irrig. Land (acres)	Crop Irrigation Requirements (1,000 ac.-ft.)	Conveyance System Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Overall Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Overall Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Overall Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Diver- sion Needed for Supply Shortage (1,000 ac.-ft.)
County		(1,000) (acres)	(1,000) (ft./ac.)	(Percent)	(1,000) (ac.-ft.)	(Percent)	(1,000) (ac.-ft.)	(Percent)	(1,000) (ac.-ft.)	(Percent)	(1,000) (ac.-ft.)	
Prairie	13.3	1.48	14.5	48	33.0	43	17.3	21	50.3	70.3	63.4	6.9
	(7.4)		(11.0)	(90)	(0.9)	(65)	(2.7)	(58)	(3.6)	(18.7)	(8.5)	(10.2)
Richland	46.3	1.30	60.2	32	241.9	51	55.8	16	297.7	368.8	355.8	13.0
	(4.0)		(5.2)	(95)	(0.2)	(65)	(1.4)	(62)	(1.6)	(8.4)	(4.2)	(4.2)
Rosebud	35.0	1.54	53.9	50	118.0	45	64.9	22	182.9	239.6	236.0	3.6
	(7.1)		(10.9)	(80)	(1.1)	(50)	(2.3)	(40)	(3.4)	(27.3)	(5.7)	(21.6)
Stillwater	30.8	1.42	43.7	45	133.7	40	65.6	18	199.3	243.0	243.0	---
	(0.4)		(0.6)	(80)	(0.1)	(50)	(0.1)	(40)	(0.2)	(1.4)	(0.4)	(0.4)
Sweet Grass	58.0	1.37	79.5	40	300.0	37	126.0	15	426.0	536.9	500.0	36.9
	(1.4)		(1.9)	(80)	(0.2)	(50)	(0.4)	(40)	(0.6)	(4.8)	(1.1)	(3.7)
Treasure	20.0	1.53	30.6	50	66.1	46	35.7	23	101.8	133.0	132.2	0.8
	(0.3)		(0.5)	(80)	(0.1)	(50)	(0.1)	(40)	(0.2)	(1.2)	(0.3)	(0.9)
Wibaux	0	1.40	---	---	---	---	---	---	---	---	---	---
	(0.7)		(1.0)	(95)	(0.1)	(55)	(0.3)	(52)	(0.4)	(1.9)	(0.8)	(1.1)
Yellowstone	98.8	1.54	152.2	50	330.0	46	178.2	23	508.2	661.5	660.0	1.5
	(1.1)		(1.7)	(80)	(0.2)	(50)	(0.4)	(40)	(0.6)	(4.2)	(1.0)	(3.2)
SUBTOTAL	569.1	1.46	825.2	44	2288.7	43	1031.4	19	3320.1	4289.1	4110.0	179.1
	(92.5)		(143.2)	(92)	(8.0)	(62)	(33.3)	(57)	(41.3)	(256.3)	(96.8)	(159.5)
LITTLE MISSOURI												
Carter	4.0	1.50	6.0	90	1.2	48	5.6	43	6.8	13.9	12.0	1.9
	(62.9)		(94.4)	(90)	(8.0)	(65)	(25.3)	(58)	(33.3)	(161.3)	(80.3)	(81.0)
Fallon	0.3	1.53	0.5	95	0.1	50	0.4	48	0.5	1.0	1.0	---
	(1.6)		(2.5)	(95)	(0.1)	(65)	(0.6)	(62)	(0.7)	(4.0)	(1.7)	(2.3)
Wibaux	0.1	1.40	0.1	95	0.0	40	0.2	38	0.2	0.4	0.3	0.1
	(1.3)		(1.8)	(95)	(0.1)	(55)	(0.5)	(52)	(0.6)	(3.5)	(1.3)	(2.2)
SUBTOTAL	4.4	1.50	6.6	90	1.3	48	6.2	43	7.5	15.3	13.3	2.0
	(65.8)		(98.7)	(90)	(8.2)	(65)	(26.4)	(58)	(34.6)	(168.8)	(83.3)	(85.5)
STATE TOTAL	2296.4	1.27	2886.3	47	6620.2	43	3405.5	20	10025.7	14074.9	12591.3	1483.6
	(346.6)		(479.2)	(87)	(50.5)	(59)	(143.7)	(51)	(194.2)	(927.5)	(399.6)	(527.9)

1/ Waterspreading acreage and data in parentheses.

TABLE III-b--YEAR 2000 IRRIGATION WATER DIVERSION REQUIREMENTS 1/
(Montana)

SUBBASIN County		Total Irrig. Land (1,000 acres)	Crop Irrigation Requirements (1,000 ac.-ft.)	Conveyance System Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Overall Effi- ciency (Percent)	Farm Losses (1,000 ac.-ft.)	Total Losses (1,000 ac.-ft.)	Diver- sion Needed for Diversions (1,000 ac.-ft.)	Available for Supply Shortage (1,000 ac.-ft.)
<u>UPPER COLUMBIA</u>										
Deer Lodge	13.7	0.87	11.9	59	17.3	48	12.9	28	30.2	42.1
Flathead	28.0	1.30	36.4	96	2.6	58	26.4	56	29.0	65.4
Granite	36.6	0.90	32.9	60	39.9	55	27.0	33	66.9	99.8
Lake	110.3	1.33	146.7	55	175.5	56	94.4	31	269.9	476.3
Lewis & Clark	2.1	0.90	1.9	52	3.6	49	1.9	26	5.5	7.4
Lincoln	7.4	1.34	9.9	60	11.2	59	6.9	35	18.1	28.0
(subsurface) Mineral	3.0	4.0	100	---	100	---	100	---	4.0	4.0
Missoula	35.0	1.30	45.5	64	50.2	51	43.7	33	93.9	139.4
Powell	69.4	0.94	65.2	59	96.5	47	73.6	28	170.1	235.3
Ravalli	106.8	1.34	143.1	65	132.9	58	103.6	38	236.5	379.6
Sanders	22.6	1.46	33.0	50	52.4	57	22.5	28	74.9	115.8
Silver Bow	2.4	1.16	2.8	75	1.7	47	2.7	35	4.4	7.9
SUBTOTAL	438.7	1.22	535.1	61	584.4	55	417.1	34	1001.5	1506.4
<u>UPPER MISSOURI</u>										
Beaverhead	329.0	1.10	361.9	58	476.5	55	296.1	32	772.6	1134.5
Blaine	70.0	1.51	105.7	67	86.8	60	70.5	40	157.3	263.0
Broadwater	49.7	1.30	64.6	67	55.8	57	48.8	38	104.6	169.2

TABLE III-b--YEAR 2000 IRRIGATION WATER DIVERSION REQUIREMENTS 1/ (Continued)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Crop Irrigation Requirements (1,000 ac.-ft.)	Conveyance System Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Overall Effi- ciency (Percent)	Farm Losses (1,000 ac.)	Diver- sion for Supply Needed Diversions Shortage (1,000 ac.-ft.)
Cascade	38.9 (7.1)	1.38 (9.8)	53.7 (80)	32.9 (50)	23.0 (5.0)	49 (40)	109.6 (24.5)
Chouteau	7.2 (5.9)	1.51 (8.9)	10.9 (80)	11.7 (1.5)	6.7 (50)	37 (40)	109.6 (24.5)
Daniels	1.0 (2.3)	1.44 (3.3)	1.5 (90)	0.6 (0.3)	5.7 (65)	1.1 (0.8)	29.3 (18.4)
Deer Lodge	8.6 (8.6)	0.90 (7.7)	59 (14.2)	38 (12.6)	22 (58)	26.8 (1.1)	7.5 (5.7)
Fergus	15.0 (3.5)	1.28 (4.5)	19.2 (90)	70 (0.3)	51 (65)	36 (58)	3.2 (3.2)
Gallatin	93.0 (12.0)	1.07 (21.4)	99.5 (90)	122.8 (1.8)	54 (55)	32 (1.0)	3.2 (1.3)
Garfield	1.4 (17.0)	1.78 (14.5)	2.5 (7.0)	90 (1.2)	50 (50)	45 (50)	53.8 (7.7)
Glacier	0.85 (8.2)	0.85 (7.1)	14.5 (10.7)	65 (80)	13.0 (50)	9.6 (2.5)	53.8 (3.7)
Golden Valley	1.51 (1.5)	1.51 (2.3)	10.7 (80)	68 (0.2)	9.9 (50)	10.3 (0.5)	30.9 (20.2)
Hill	9.8 (9.3)	1.49 (13.9)	14.6 (80)	65 (2.3)	12.1 (50)	7.9 (7.2)	3.2 (0.7)
Jefferson	27.0 (27.0)	1.23 (33.2)	33.2 (60)	38.2 (2.3)	58 (50)	24.0 (40)	34.6 (34.6)
Judith Basin	9.0 (2.5)	1.11 (2.8)	10.0 (90)	70 (0.3)	50 (65)	10.0 (0.9)	34.6 (34.6)
Lewis & Clark	41.5 (41.5)	1.42 (58.9)	58.9 (58)	77.6 (0.8)	55 (50)	48.2 (1.5)	95.4 (95.4)
Liberty	3.3 (3.1)	1.42 (4.4)	4.7 (6.6)	52 (90)	7.0 (0.9)	62 (50)	35 (58)
Madison	140.5 (8.6)	1.12 (13.2)	157.4 (50.5)	61 (90)	173.5 (0.9)	58 (65)	125.8 (1.2)
McCone	4.3 (45.1)	1.53 (1.12)	6.6 (50.5)	90 (101.0)	1.3 (0.9)	5.6 (50)	32 (40)
Meagher	0.0 (4.0)	1.53 (10.0)	19.5 (0.8)	66 (80)	18.9 (0.1)	49 (50)	14.6 (1.1)
Musselshell	11.6 (0.5)	1.68 (15.3)	19.5 (75)	66 (10.2)	53 (50)	17.3 (15.3)	55.7 (25.5)
Petroleum	10.0 (4.0)	1.53 (6.1)	10.0 (90)	75 (1.4)	10.2 (65)	40.8 (1.8)	0.5 (4.4)

TABLE III-b--YEAR 2000 IRRIGATION WATER DIVERSION REQUIREMENTS 1/ (Continued)

SUBBASIN County		Total Irrig. Land (1,000 acres)	Crop Irrigation Requirements (1,000 ft./ac.)	Conveyance System Efficiency (Percent) ac.-ft.)	Farm Losses (1,000 ac.-ft.)	Overall Effi- ciency (Percent) ac.-ft.)	Farm Losses (1,000 ac.-ft.)	Total Losses (1,000 ac.-ft.)	Diver- sion Needed (1,000 ac.-ft.)	Available for Diversions acres - - - (1,000 ac.-ft.)	Supply Shortage acres - - - (1,000 ac.-ft.)
Phillips	50.0 (10.5)	1.43 (15.0)	71.5 (90)	35.8 (1.2)	50 (65)	71.5 (3.7)	40 (58)	107.3 (25.7)	178.8 (11.7)	- - - (14.0)	- - -
Pondera	79.7 (44.9)	0.86 (9.0)	68.5 (38.6)	67.1 (80)	55 (50)	56.1 (22.0)	36 (40)	123.2 (33.0)	191.7 (96.5)	- - - (55.0)	- - - (41.5)
Roosevelt	9.0 (9.0)	1.50 ---	13.5 (13.5)	80 (90)	6.8 (1.0)	50 (65)	40 (58)	20.3 (4.2)	33.8 (23.1)	- - - (10.0)	- - - (13.1)
Sheridan	0 (5.2)	1.36 ---	7.1 (90)	---	---	---	---	---	---	- - - (11.2)	- - - (5.5)
Silver Bow	4.6 (4.1)	0.90 5.5	4.1 60	7.1 55	7.0 (50)	7.0 (1.4)	4.6 (50)	26 (4.2)	15.7 (2.1)	- - - (5.7)	- - - (2.0)
Teton	122.4 (18.6)	1.12 2.9	137.1 (20.8)	172.6 (3.5)	65 (80)	73.8 (7.0)	36 (40)	246.4 (10.5)	383.5 (52.1)	- - - (17.5)	- - - (34.6)
Toole	2.5 (5.4)	1.15 6.2	2.9 (6.2)	7.0 (80)	1.8 (1.4)	7.0 (50)	1.2 (2.7)	49 (40)	5.9 (4.1)	- - - (15.5)	- - - (8.7)
Valley	40.0 (25.0)	1.45 36.0	58.0 (36.3)	29.0 (2.8)	50 (65)	58.0 (8.8)	40 (58)	87.0 (11.6)	145.0 (62.0)	- - - (27.8)	- - - (34.2)
Wheatland	36.0 (1.2)	1.13 40.7	50 (1.4)	81.3 (80)	50 (0.2)	40.7 (50)	25 (0.4)	122.0 (40)	162.7 (3.4)	- - - (1.0)	- - - (2.4)
SUBTOTAL	1284.2 (188.3)	1.19 (237.3)	1519.4 (84)	62 (34.3)	1689.2 (55)	56 (83.7)	1199.5 (46)	35 (118.0)	4409.6 (501.5)	4407.6 (219.5)	2.0 (282.0)
<u>YELLOWSTONE</u>											
Big Horn	63.0 (1.6)	1.45 1.40	91.4 (2.3)	68 (80)	79.6 (0.3)	54 (50)	77.8 (0.5)	37 (40)	157.4 (0.8)	248.8 (5.8)	- - - (1.3)
Carbon	96.4 -	1.40 -	135.0 -	67 -	130.3 -	51 -	129.7 -	34 -	260.0 -	395.0 -	- - -
Custer	37.0 (34.6)	1.63 1.56	60.3 (56.4)	69 (95)	50.2 (1.8)	54 (70)	51.4 (10.4)	37 (66)	101.6 (12.2)	161.9 (84.8)	- - - (36.4)
Dawson	17.5 (4.0)	1.56 0	27.3 (6.2)	58 (95)	34.7 (0.2)	57 (70)	20.6 (1.2)	33 (66)	55.3 (1.4)	82.6 (9.4)	- - - (4.2)
Fallon	0 (8.9)	1.53 1.34	---	---	---	---	---	---	---	- - - (20.4)	- - - (10.8)
Park	51.6 -	1.34 1.52	69.1 (31.9)	60 (90)	78.1 (2.3)	59 (70)	48.1 (2.7)	35 (66)	126.2 (3.2)	195.3 (9.6)	- - - (195.3)
Powder River	4.9 (21.0)	1.52 1.52	7.5 (90)	90 (2.3)	1.5 (70)	54 (63)	6.3 (6.3)	49 (63)	7.8 (8.6)	15.3 (50.7)	- - - (23.3)

TABLE III-b--YEAR 2000 IRRIGATION WATER DIVERSION REQUIREMENTS 1/ (Continued)

SUBBASIN County		Total Irrig. Land (1,000 acres)	Crop Irrigation Requirements (1,000 ac./ac.)	Conveyance System Efficiency (Percent)	Farm Losses (1,000 ac.-ft.)	Overall Effi- ciency (Percent)	Farm Losses (1,000 ac.-ft.)	Total Losses (1,000 ac.-ft.)	Diver- sion Needed for Supply Shortage -- (1,000 ac.-ft.)
Prairie		9.8 (7.4)	1.48 (11.0)	95 (90)	1.3 (0.9)	57 (65)	11.0 (2.7)	54 (58)	12.3 (3.6)
Richland		46.3 (4.0)	1.30 (5.2)	60.2 (95)	86.0 (0.2)	56 (70)	49.2 (1.2)	31 (67)	135.2 (1.4)
Rosebud		35.0 (7.1)	1.54 (10.9)	53.9 (80)	47.0 (1.1)	54 (50)	45.9 (2.3)	37 (40)	92.9 (3.4)
Stillwater		30.8 (0.4)	1.42 (0.6)	43.7 (80)	70 (0.1)	70 (50)	37.5 (0.1)	35 (40)	125.0 (0.2)
Sweet Grass		58.0 (1.4)	1.37 (1.9)	79.5 (80)	67 (0.2)	78.3 (50)	50 (0.4)	33 (40)	157.7 (0.6)
Treasure		20.0 (0.3)	1.53 (0.5)	30.6 (80)	68 (0.1)	26.2 (50)	55 (0.1)	37 (40)	51.2 (0.2)
Wibaux		0 (0.7)	1.40 (1.0)	---	---	---	---	---	81.8 (1.2)
39 Yellowstone		98.8 (1.1)	1.54 (1.7)	152.2 (80)	68 (0.2)	130.2 (50)	55 (0.4)	37 (40)	254.6 (0.6)
SUBTOTAL		569.1 (92.5)	1.46 (143.2)	825.2 (92)	66 (8.0)	780.9 (68)	54 (28.6)	712.6 (62)	36 (36.6)
<u>LITTLE MISSOURI</u>								1493.5 (238.2)	2318.7 (96.8)
Carter		4.0 (62.9)	1.50 (94.4)	6.0 (90)	90 (8.0)	1.3 (70)	52 (21.7)	47 (63)	6.8 (29.7)
Fallon		0.3 (1.6)	1.53 (1.40)	0.5 (2.5)	95 (0.1)	0.1 (0.1)	53 (70)	0.4 (0.5)	12.8 (149.8)
Wibaux		0.1 (1.3)	1.40 (1.8)	0.1 (95)	95 (0.1)	0.0 (0.1)	50 (60)	0.2 (0.5)	0.5 (0.6)
SUBTOTAL		4.4 (65.8)	1.50 (98.7)	6.6 (90)	90 (8.2)	1.4 (70)	52 (22.7)	47 (63)	7.5 (30.9)
STATE TOTAL		2296.4 (346.6)	1.27 (479.2)	2886.3 (87)	63 (50.5)	3055.9 (61)	2335.3 (135.0)	35 (53)	5391.2 (185.5)
									14.1 (156.7)
									12.8 (83.3)
									100.5 (73.4)
									100.5 (496.8)

1/ Waterspreading acreage and data in parentheses.

TABLE IV-a--INVENTORY OF EXISTING OFF-FARM SYSTEMS
(Montana)

SUBBASIN County	Irrig. Land (1,000 acres)	Reservoir Storage (1,000 ac.-ft.)	Supply Adequate Supply (1,000 ac.) (%)	Return System			Conveyance Systems						
				Total 1/	Main Drains (1,000 feet)	Land With Adequate Return Systems (1,000 ac.) (%)	Canals and Laterrals (1,000 feet)	Pipelines (1,000 feet)	Irrigation Structures (Number)	Land With Adequate Conveyance Systems (1,000 ac.) (%)			
<u>UPPER COLUMBIA</u>													
Deer Lodge	13.7	0.2	6.4	47	14.8	8.5	62	658.8	18.8	---	183	3.6	26
Flathead	28.0	0.4	21.0	75	720.8	26.0	93	70.0	---	---	20	20.0	71
Granite	36.6	22.2	36.0	98	25.0	30.0	82	2124.7	51.0	10.0	400	10.0	27
Lake	110.3	100.0	13.0	12	460.2	100.0	91	6100.0	84.5	---	3000	110.0	100
Lewis & Clark	2.1	---	2.1	100	1.7	0.1	5	325.0	---	0.2	40	0.4	19
Lincoln	10.4	2.1	6.4	62	244.5	7.2	69	314.1	---	---	75	5.4	52
Mineral	1.4	---	0.9	64	6.4	1.0	71	7.0	---	7.0	14	0.7	50
Missoula	35.0	1.2	24.0	69	80.0	26.0	74	521.8	7.8	13.0	230	7.0	20
Powell	69.4	22.4	22.6	33	267.9	50.0	72	6300.0	6.4	2.0	1000	10.0	14
Ravalli	106.8	89.0	40.0	37	408.7	89.8	84	6360.0	11.4	152.0	1400	---	0
Sanders	22.6	6.7	2.6	12	200.0	19.6	87	879.8	1.0	5.0	800	16.0	71
Silver Bow	2.4	---	1.7	71	5.8	0.7	29	120.0	7.3	1.0	170	0.2	8
SUBTOTAL	438.7	244.2	176.7	40	2435.8	358.9	82	23781.2	188.2	190.2	7332	183.3	42
<u>UPPER MISSOURI</u>										1800	100.0	30	
Beaverhead	329.0	270.0	220.0	67	295.7	20.0	6	1591.9	117.5	---	1800	100.0	30
Blaine	70.0	2.7	59.4	85	1133.9	45.0	64	1408.0	0.4	0.2	600	40.0	57
Broadwater	49.7	0.1	30.0	60	126.0	47.0	95	267.7	4.2	20.0	456	20.0	40

TABLE IV-a--INVENTORY OF EXISTING OFF-FARM SYSTEMS (Montana) (Continued)

		Supply			Return System			Canals			Conveyance Systems			
Total ^{1/}		Reservoir	Land With Adequate Supply	Main Drains	Land With Adequate Return Systems	Laterals	Canal and Lining	Pipelines	Irrigation Structures	Canals and Lining	Pipelines	Irrigation Structures	Conveyance Systems	
Subbasin County	Irrig. Land (1,000 acres)	(1,000 ac.-ft.)	(1,000 ac.)	(% of feet)	(1,000 ac.)	(%)	(1,000 feet)	(1,000 feet)	(Number)	(1,000 feet)	(1,000 feet)	(Number)	(1,000 ac.) (%)	
Cascade	46.0	0.2	38.9	85	317.0	38.9	85	2205.0	---	10.0	418	19.0	41	
Chouteau	(7.1)	3.0	1.5	11	177.0	2.8	21	235.9	---	---	71	1.4	11	
Daniels	(5.9)	---	0.9	27	2.0	1.0	30	15.0	---	---	30	0.9	27	
Deer Lodge	(3.3)	---	8.6	100	9.4	5.5	64	421.2	12.0	---	117	2.4	28	
Fergus	(2.3)	---	4.0	22	10.0	12.0	65	300.0	---	---	220	10.0	54	
Gallatin	(3.5)	12.0	53.0	57	466.0	5.0	5	24126.0	---	---	10000	12.0	13	
Garfield	(3.5)	7.0	1.4	10	---	1.4	10	---	---	---	16	1.3	10	
Glacier	(12.0)	---	99.5	---	0	---	0	1316.0	8.0	---	1733	---	0	
Golden Valley	(25.2)	---	5.6	65	23.8	6.3	73	473.9	---	2.0	178	2.5	29	
Hill	(8.2)	1.1	3.0	16	108.0	8.8	46	105.6	---	---	150	0.8	4	
Jefferson	(1.5)	9.0	19.1	12.5	13.5	50	525.0	20.0	74	4000.0	1.1	---	600	0.6
Judith Basin	(9.3)	10.0	11.5	3.0	26	15.0	6.5	57	125.0	---	2.0	30	2.0	17
Lewis & Clark	(2.5)	27.0	41.5	0.7	40.0	96	276.8	9.9	24	6275.0	142.7	4.8	760	7.8
Liberty	(3.1)	1.0	6.4	0.8	12	2.0	3.0	4.7	53.0	---	2.0	40	0.8	12
Madison	(4.0)	64.1	45.1	46	464.5	63.0	45	2340.0	91.5	33.4	2640	28.0	20	
McCone	(8.6)	13.1	12.9	3.2	25	10.5	2.1	16	146.4	---	---	141	4.3	33
Meagher	(45.1)	4.7	45.1	3.1	7	159.7	40.0	89	379.3	7.5	---	270	18.0	40
Musselshell	(0.5)	0.7	12.1	10.6	88	124.0	10.1	83	701.0	4.0	0.7	290	2.9	24
Petroleum	(4.0)	20.0	14.0	5.0	36	20.0	8.0	57	242.0	15.0	---	70	4.0	29

TABLE IV-a--INVENTORY OF EXISTING OFF-FARM SYSTEMS (Montana) (Continued)

SUBBASIN County		Supply			Return System			Canals			Conveyance Systems		
Total Irrig. Land (1,000 acres)	Irrig. Land (1,000 acres)	Reservoir Storage (1,000 ac.-ft.)	Land With Adequate Supply (1,000 ac.)	Main Drains (1,000 feet)	Adequate Supply (1,000 ac.)	Return Systems (1,000 feet)	Lateral (1,000 feet)	Canal Lining (1,000 feet)	Pipelines (1,000 feet)	Canal Lining (1,000 feet)	Irrigation Structures (Number)	Land With Adequate Conveyance Systems (1,000 ac.)	
Phillips	60.5 (10.5)	150.0	35.0	58	950.0	35.0	58	630.0	---	2.0	400	40.0	66
Pondera	124.6 (44.9)	148.3	69.7	56	565.2	50.0	40	2640.0	---	112.0	1000	10.0	8
Roosevelt	18.0 (9.0)	44.0	8.0	44	200.0	3.5	19	200.0	---	---	130	4.5	25
Sheridan	5.2 (5.2)	---	---	0	10.0	4.5	87	---	---	---	15	3.0	58
Silver Bow	4.6	---	3.3	72	11.3	1.3	28	230.0	14.2	2.0	330	0.5	11
Teton	141.0 (18.6)	230.0	80.1	57	2087.5	57.2	41	3341.5	13.0	6.2	6544	68.6	49
Toole	7.9 (5.4)	1.0	1.9	24	25.0	1.5	19	20.0	1.1	1.0	50	1.0	13
Valley	65.0 (25.0)	120.0	26.0	40	300.0	20.0	31	368.0	---	---	200	26.0	40
Wheatland	37.2 (1.2)	107.0	28.5	77	149.0	35.3	95	2592.0	---	3.0	900	9.0	24
SUBTOTAL	1472.5 (188.3)	1331.7	822.1	56	8564.4	564.6	38	56749.4	432.2	201.3	30199	441.3	30
YELLOWSTONE													
Big Horn	64.6 (1.6)	91.0	59.0	91	460.9	50.0	77	2450.0	94.0	5.0	1575	22.0	34
Carbon	96.4	30.0	96.4	100	202.4	87.4	91	4340.0	15.0	26.0	1200	24.1	25
Custer	71.6 (34.6)	2.0	27.7	39	102.5	9.2	13	513.7	---	---	2219	27.7	39
Dawson	21.5 (4.0)	2.0	17.5	81	200.0	10.0	47	647.0	1.2	---	833	17.5	81
Fallon	8.9 (8.9)	---	---	0	---	8.9	100	---	---	---	---	---	0
Park	51.6	3.4	31.0	60	107.2	48.6	94	2580.0	11.2	---	600	20.0	39
Powder River	25.9 (21.0)	0.9	0.9	3	9.0	1.0	4	19.4	---	---	272	1.5	6

TABLE IV-a--INVENTORY OF EXISTING OFF-FARM SYSTEMS (Montana) (Continued)

Total irrigated land acreage by county includes waterspreading acreage in parentheses.

TABLE IV-b(1)--INVENTORY OF EXISTING ON-FARM IRRIGATION SYSTEMS
(Montana)

SUBBASIN County		Total Irrig. Land (1,000 acres)	Land Good	Land With Surface Systems (1,000 acres)	Irrigation Pipelines (1,000 feet)	Canal Lining (1,000 feet)	Irrigation Field Ditches (1,000 feet)	Land Leveling (1,000 acres)	Land Smoothing (1,000 acres)	Regulating Reservoirs (Number)	Irrigation Structures (Number)	Tailwater Recovery Systems (Number)	
<u>UPPER COLUMBIA</u>		Deer Lodge	13.7	0.7	2.1	23.7	---	1220.0	0.2	4	330	1	
Flathead		28.0	23.5	4.0	327.1	---	135.8	---	0.3	46	163	---	
Granite		36.6	3.3	4.2	97.7	7.9	2022.0	0.3	0.2	2	2018	10	
Lake		110.3	38.0	5.7	850.8	---	8700.0	1.5	0.8	3	2509	---	
Lewis & Clark		2.1	0.2	0.5	4.3	---	207.0	0.4	0.1	---	60	---	
Lincoln		10.4	3.9	5.0	58.1	---	622.3	0.3	0.4	---	476	---	
Mineral		1.4	0.9	0.1	36.1	---	292.0	---	---	---	61	---	
Missoula		35.0	12.0	0.6	251.6	---	2029.8	3.1	0.4	---	920	---	
Powell		69.4	3.4	10.4	77.4	---	6600.0	1.5	0.9	5	2000	2	
Ravalli		106.8	52.0	11.6	611.5	---	567.5	6.6	1.8	36	1226	10	
Sanders		22.6	5.3	4.0	166.5	---	1022.6	5.0	1.6	2	300	25	
Silver Bow		2.4	0.2	0.4	6.8	---	306.0	0.1	0.2	---	102	---	
SUBTOTAL		438.7	143.4	48.6	2511.6	7.9	23725.0	19.0	6.9	98	10165	48	
<u>UPPER MISSOURI</u>		Beaverhead	329.0	20.0	7.6	311.7	10.0	3012.6	2.8	1.4	11	4200	---
Blaine		70.0	2.7	47.3	8.0	1.4	256.2	15.2	---	---	1040	---	
Broadwater		49.7	6.2	6.0	156.1	3.1	5370.0	8.1	0.5	4	2334	---	

TABLE IV-b(1)--INVENTORY OF EXISTING ON-FARM IRRIGATION SYSTEMS (Montana) (Continued)

Subbasin County	Total ^{1/} acres)	Land With Good Surface Systems (1,000 acres)	Irrigation Sprinkler Land (1,000 acres)	Canal Pipelines (1,000 feet)	Irrigation Field Ditches (1,000 feet)	Land Leveling (1,000 feet)	Land Smoothing (1,000 acres)	Regulating Reservoirs (Number)	Irrigation Structures (Number)	Tailwater Recovery Systems (Number)
Cascade	46.0 (7.1)	1.4 1.5	37.5 5.6	31.8 12.0	612.0 ---	4170.0 1170.0	0.4 0.9	16.7 0.2	1 7	4288 533
Chouteau	13.1 (5.9)	---	1.0	1.3 1.5	---	33.0 780.0	1.0 ---	0.4 ---	1 ---	130 210
Daniels	3.3 (2.3)	---	0.4	1.5 10.8	---	2550.0 270.0	4.0 15.0	---	1 ---	1200 ---
Deer Lodge	8.6 18.5 (3.5)	---	1.0 1.0	6.7 10.8	---	8648.0 270.0	7.6 0.4	1 1	1453 1453	---
Fergus	93.0 17.0	48.0 ---	1.4 1.4	1.0 1.0	---	70.0 70.0	1.3 ---	---	100 100	---
Gallatin	13.4 (12.0)	---	0.1 0.1	13.5 4.0	---	63.8 63.8	1.0 1.0	1.7 1.7	---	---
Garfield	25.2 (8.2)	0.8 0.8	1.8 1.8	15.4 15.4	---	213.0 528.0	3.0 3.7	0.1 3.0	2 1	451 450
Glacier	8.6 (1.5)	1.2 1.2	6.9 6.9	10.8 25.2	---	4500.0 4500.0	1.5 1.5	0.2 0.2	4 4	600 600
Golden Valley	19.1 (9.3)	---	2.0 2.0	1.0 1.0	---	400.0 400.0	0.5 0.5	---	---	180 180
Hill	1.7 27.0	1.7 1.2	8.5 6.9	10.8 25.2	---	4154.0 4154.0	10.8 1.5	1.8 1.2	12 12	1140 1140
Jefferson	11.5 (2.5)	---	10.4 1.4	44.9 10.4	---	263.2 2235.0	0.6 5.4	---	---	329 11160
Judith Basin	41.5 (3.1)	0.3 0.3	3.0 3.0	5.6 5.6	---	9820.0 130.6	0.8 4.2	1.5 0.9	2 ---	844 281
Lewis & Clark	140.5 (41.5)	11.7 11.7	18.6 18.6	113.2 113.2	---	426.0 2235.0	7.1 5.4	2 1.7	2 8	808 11160
Liberty	6.4 (3.1)	---	---	---	---	700.0 9820.0	4.0 0.8	0.3 1.5	1 2	10 844
Madison	12.9 (8.6)	0.1 45.1	2.4 1.1	1.3 2.6	---	426.0 9820.0	7.1 0.8	0.3 1.5	1 2	10 844
McCone	12.1 (0.5)	0.5 0.2	3.5 7.3	1.0 1.2	---	426.0 700.0	7.1 4.0	0.3 4.0	1 ---	10 800
Meagher	14.0 (4.0)	---	---	---	---	426.0 700.0	7.1 4.0	0.3 4.0	1 ---	10 800
Musselshell	12.1 (0.5)	0.5 0.2	3.5 7.3	1.0 1.2	---	426.0 700.0	7.1 4.0	0.3 4.0	1 ---	10 800
Petroleum	14.0 (4.0)	---	---	---	---	426.0 700.0	7.1 4.0	0.3 4.0	1 ---	10 800

TABLE IV-b(1)--INVENTORY OF EXISTING ON-FARM IRRIGATION SYSTEMS (Montana) (Continued)

SUBBASIN County	Total ^{1/}	Land Good	Land With Surface Systems	Irrigation Canal Pipelines	Field Ditches (1,000 feet)	Land Leveling (1,000 feet)	Smoothing (1,000 acres)	Irrigation Reservoirs (Number)	Regulating Structures (Number)	Tailwater Recovery Systems (Number)
Phillips	60.5 (10.5)	0.7	50.0	1.5	---	3000.0	16.0	---	1	2200
Pondera	124.6 (44.9)	5.1	79.7	---	135.6	21519.0	10.1	1.2	---	4000
Roosevelt	18.0 (9.0)	---	13.0	---	1.0	600.0	6.0	---	---	450
Sheridan	5.2 (5.2)	---	---	---	---	---	---	---	---	130
Silver Bow	4.6 (4.6)	0.5	0.8	13.2	---	594.0	0.2	0.3	1	198
Teton	141.0 (18.6)	1.5	10.7	14.5	1.4	36669.5	13.9	2.8	---	4364
Toole	7.9 (5.4)	1.2	1.3	1.0	---	188.0	1.0	0.3	---	50
- 46 - Valley	65.0 (25.0)	0.4	40.0	1.2	---	1900.0	27.0	---	10	3500
Wheatland	37.2 (1.2)	0.6	6.6	3.4	3.2	1492.4	4.4	---	---	1130
SUBTOTAL	1472.5 (188.3)	79.3	449.3	1090.2	800.5	135396.3	178.8	19.1	68	48553
YELLOWSTONE										63
Big Horn	64.6 (1.6)	1.2	12.9	5.0	25.0	1277.5	14.8	0.1	2	1900
Carbon	96.4	4.6	13.1	134.0	39.0	982.5	9.1	0.9	1	2760
Custer	71.6 (34.6)	0.3	7.3	15.3	114.1	1064.7	18.6	1.0	1	2220
Dawson	21.5 (4.0)	0.6	16.9	8.0	34.8	800.0	16.9	---	---	1700
Fallon	8.9 (8.9)	---	---	---	---	---	---	0.9	---	---
Park	51.6	1.2	1.5	31.8	---	5000.0	5.0	4.0	---	1200
Powder River	25.9 (21.0)	---	1.8	0.2	4.7	28.4	1.8	0.8	2	145

TABLE IV-b(1)--INVENTORY OF EXISTING ON-FARM IRRIGATION SYSTEMS (Montana) (Continued)

SUBBASIN County		Land With		Irrigation		Land		Regulating		Irrigation	
Total ^{1/}	Land	Good	Surface	Canal	Field	Land	Smooth	Ditches	(1,000	Reservoirs	Structures
Irrig.	Sprinkler	Surface	Pipelines	Lining	Ditches	Leveling	acres)	(1,000	acres)	(Number)	(Number)
Land (1,000 acres)	(1,000 acres)	(acres)	(feet)	(feet)	(feet)	(1,000 acres)	(1,000 acres)	(feet)	(1,000 acres)	(Number)	(Number)
Prairie	17.2 (7.4) 50.3 (4.0)	1.3	9.8	29.6	30.7	380.2	9.5	·	0.3	1	880
Richland	0.4	16.4	3.3	39.6	973.4	22.2	0.4	·	1	4864	2
Rosebud	42.1 (7.1) 31.2 (0.4)	2.8	6.6	32.2	15.1	392.8	11.6	0.3	1	1300	---
Stillwater	0.4	7.0	5.5	55.6	524.9	6.8	0.5	·	·	1760	3
Sweet Grass	59.4 (1.4) 20.3 (0.3)	0.7	13.9	21.1	11.2	1959.2	2.1	2.4	·	2460	17
Treasure	0.3	5.3	3.0	3.3	469.3	9.0	0.1	·	·	600	---
Wibaux	0.7 (0.7) 99.9 (1.1)	---	---	---	---	---	---	---	---	---	---
Yellowstone	2.3	51.6	19.1	205.0	2840.0	16.8	2.5	3	3700	5	
SUBTOTAL	661.6 (92.5)	16.1	164.1	308.1	578.1	16732.9	144.2	14.2	12	25489	94
<u>LITTLE MISSOURI</u>											
Carter	66.9 (62.9)	0.2	3.2	---	---	15.7	1.6	0.7	2	422	---
Fallon	1.9 (1.6)	---	0.3	---	---	10.9	0.3	0.1	---	28	---
Wibaux	1.4 (1.3)	---	0.1	---	---	1.3	0.1	---	---	---	---
SUBTOTAL	70.2 (65.8)	0.2	3.6	---	---	27.9	2.0	0.8	2	450	---
STATE TOTAL	2643.0 (346.6)	239.0	665.6	3909.9	1386.5	175882.1	344.0	41.0	180	84657	205

1/ Total irrigated land acreage by county includes waterspreading acreage in parentheses.

TABLE IV-b(2)-INVENTORY OF EXISTING ON-FARM IRRIGATION SYSTEMS
(Montana)

<u>SUBBASIN</u>	<u>Total Irrig.</u>	<u>Tile Drains</u>	<u>Open Drains</u>	<u>Land Grading</u>	<u>Land With Adequate On-Farm Systems</u>	<u>Irrigation Water Management</u>	<u>Lands With Adequate Water Management</u>	<u>Lands With Off-Farm and On-Farm Systems and Management</u>	<u>Water Management (%)</u>	<u>Lands With Adequate Water Management (%)</u>	<u>Off-Farm and On-Farm Systems and Management (%)</u>
<u>County</u>	<u>(1,000 feet) acres</u>	<u>(1,000 feet)</u>	<u>(1,000 acres)</u>	<u>(1,000 feet)</u>	<u>(1,000 acres)</u>	<u>(1,000 ac.) (%)</u>	<u>(1,000 ac.) (%)</u>	<u>(1,000 ac.) (%)</u>	<u>(1,000 ac.) (%)</u>	<u>(1,000 ac.) (%)</u>	<u>(1,000 ac.) (%)</u>
<u>UPPER COLUMBIA</u>											
Deer Lodge	13.7	1.8	---	---	2.1	15	1.0	1.0	7	1.0	7
Flathead	28.0	44.4	27.8	---	20.0	71	18.0	64	18.0	64	64
Granite	36.6	20.7	67.0	---	3.3	9	3.3	9	3.3	9	9
Lake	110.3	15.4	5.0	---	43.7	40	40.2	36	13.0	12	12
Lewis & Clark	2.1	0.7	1.0	---	0.7	33	0.2	10	0.2	10	10
Lincoln	10.4	1.7	316.8	---	5.9	57	3.7	36	3.7	36	36
Mineral	1.4	1.8	1.6	---	0.7	50	0.5	0.5	0.5	0.5	36
Missoula	35.0	12.2	48.0	---	12.0	34	9.2	26	9.2	26	26
Powell	69.4	13.2	2.5	---	10.0	14	5.0	5.0	7	5.0	7
Ravalli	106.8	74.3	9.9	0.1	58.6	55	24.0	22	24.0	22	22
Sanders	22.6	0.6	100.0	0.1	9.3	41	9.7	43	9.3	41	41
Silver Bow	2.4	0.4	3.4	---	0.6	25	0.3	12	0.3	12	12
<u>SUBTOTAL</u>	<u>438.7</u>	<u>187.2</u>	<u>583.0</u>	<u>0.2</u>	<u>166.9</u>	<u>38</u>	<u>115.1</u>	<u>115.1</u>	<u>26</u>	<u>87.5</u>	<u>20</u>
<u>UPPER MISSOURI</u>											
Beaverhead	329.0	1.3	4.0	---	23.6	7	16.1	16.1	5	16.1	5
Blaine	70.0	1.9	17.0	---	21.0	30	---	---	0	---	0
Broadwater	49.7	5.0	2.0	---	14.3	29	10.0	10.0	20	10.0	20

TABLE IV-b(2)--INVENTORY OF EXISTING ON-FARM IRRIGATION SYSTEMS (Montana) (Continued)

<u>SUBBASIN County</u>	Total	1/	Drainage	Land With Adequate Water Management	Irrigation : Lands With Adequate Off-Farm and On-Farm Systems and Management (%) : (1,000 ac.)	(1,000 ac.)						
Cascade	46.0	---	443.0	0.1	19.0	41	20.0	43	19.0	41		
Chouteau	(7.1)	4.1	291.1	---	0.4	3	1.4	0.7	5	0.4	3	
Daniels	(5.9)	---	10.0	---	0.5	15	0.2	0.2	6	0.2	6	
Deer Lodge	(2.3)	---	---	---	1.5	17	0.6	0.6	7	0.6	7	
Fergus	8.6	---	---	---	7.0	38	3.0	3.0	16	3.0	16	
Gallatin	18.5	---	30.0	---	60.0	65	17.0	20.0	22	20.0	22	
Garfield	(3.5)	84.0	324.0	---	1.1	8	0.4	0.4	3	0.4	3	
Glacier	93.0	---	1.0	---	---	---	---	---	0	---	0	
Golden Valley	13.4	---	(12.0)	0.6	2.5	---	0	---	---	0	---	
Hill	25.2	---	(8.2)	---	21.2	---	2.6	30	0.8	0.8	9	
Jefferson	(1.5)	---	(1.5)	---	51.6	0.6	2.0	10	0.8	0.8	4	
Judith Basin	19.1	---	(9.3)	3.3	3.6	---	6.9	26	3.0	3.0	2	
Lewis & Clark	27.0	---	122.0	175.0	---	---	1.0	9	1.0	1.0	9	
Liberty	11.5	---	(2.5)	122.0	---	3.0	---	4.7	4.7	4.7	11	
Madison	41.5	---	(2.5)	10.2	8.2	---	0.8	12	0.5	0.5	8	
McCone	45.1	---	(8.6)	---	62.8	---	2.5	19	1.2	1.2	9	
Meagher	45.1	5.6	---	---	---	---	15.8	35	2.9	2.9	6	
Musselshell	12.1	11.6	(0.5)	45.0	---	4.0	33	0.5	0.5	4	0.5	
Petroleum	14.0	1.0	(4.0)	25.0	---	3.0	21	1.5	1.5	11	1.5	

TABLE IV-b(2)--INVENTORY OF EXISTING ON-FARM IRRIGATION SYSTEMS (Montana) (Continued)

SUBBASIN County	Total ^{1/}	Irrig. Land (1,000 acres)	Tile Drains (1,000 feet)	Open Drains (1,000 feet)	Land Grading (1,000 acres)	Land With Adequate On-Farm Systems (1,000 acres)	Irrigation Water Management (1,000 ac.)	Lands With Adequate Water Management (1,000 ac.)	Lands With Off-Farm and On-Farm Systems and Management (1,000 ac.)
Phillips	60.5	(10.5)	---	1200.0	---	10.0	17	4.0	7
Pondera	124.6	(44.9)	5.8	77.7	---	10.0	8	18.6	15
Roosevelt	18.0	(9.0)	---	160.0	---	5.0	28	1.5	8
Sheridan	5.2	(5.2)	---	100.0	---	4.0	76	---	0
Silver Bow	4.6	0.9	6.6	---	1.3	28	0.6	13	0.6
Teton	141.0	(18.6)	68.0	33.0	0.2	34.3	24	3.0	2
Toole	7.9	(5.4)	7.6	7.0	---	0.5	6	0.5	6
Valley	65.0	(25.0)	---	40.0	---	20.0	31	4.0	6
Wheatland	37.2	(1.2)	6.2	8.4	---	7.2	19	1.2	3
Subtotal	1472.5	(188.3)	339.1	3153.7	0.9	308.9	21	132.3	134.6
Yellowstone									
Big Horn	64.6	(1.6)	7.7	515.5	---	14.1	22	11.0	17
Carbon	96.4	(4.0)	74.4	422.5	---	17.7	18	12.3	13
Custer	71.6	(34.6)	5.8	1001.6	---	27.7	39	9.4	13
Dawson	21.5	(4.0)	14.6	282.7	---	12.6	59	3.6	17
Fallon	8.9	(8.9)	---	---	---	0	---	0	0
Park	51.6	---	63.5	---	2.7	5	2.5	5	5
Powder River	25.9	(21.0)	---	9.1	0.8	1.8	7	0.9	3

TABLE IV-b(2)--INVENTORY OF EXISTING ON-FARM IRRIGATION SYSTEMS (Montana) (Continued)

SUBBASIN County	Total ^{1/}	Tile	Open Drains	Land Grading	Irrigation Water Management	Lands With Adequate Water Management	Irrigation Water Management	Lands With Adequate Water Management	Irrigation Water Management
	(1,000 acres)	(1,000 feet)	(1,000 feet)	(1,000 acres)	(1,000 ac.) (%)	(1,000 ac.) (%)	(1,000 ac.) (%)	(1,000 ac.) (%)	(1,000 ac.) (%)
Prairie	17.2 (7.4)	14.4 (7.4)	94.2 ---	3.3 22.2	19 44	0.9 22.0	0.9 44	5 22.0	0.9 22.0
Richland	50.3 (4.0)	15.1 (4.0)	1158.8 28.8	7.0 ---	9.4 22	6.1 6.1	14 14	44 6.1	44 6.1
Rosebud	42.1 (7.1)	0.5 10.8	28.8 3.0	---	7.4 24	0.7 0.7	2 2	2 0.7	2 0.7
Stillwater	31.2 (0.4)	5.4 64.9	64.9 0.7	7.4 14.6	24 25	0.7 0.7	2 1	2 0.7	2 0.7
Sweet Grass	59.4 (1.4)	9.1 300.0	300.0 ---	5.6 ---	28 0	4.0 ---	20 0	4.0 0	20 0
Treasure	20.3 (0.3)	0.7 ---	---	53.9 54	19.4 19.4	19.4 19	19.4 19	19.4 19	19.4 19
Wibaux	0.7 (0.7)	295.3 304.2	304.2 ---	53.9 54	19.4 19.4	19.4 19	19.4 19	19.4 19	19.4 19
Yellowstone	99.9 (1.1)	661.6 (92.5)	453.1 4248.8	8.5 193.0	29 93.5	93.5 14	93.5 14	93.5 14	93.5 14
<hr/>									
<u>LITTLE MISSOURI</u>									
Carter	66.9 (62.9)	---	3.8	0.6	51.5 77	0.1	0.1 0	0.1 0	0 0
Fallon	1.9 (1.6)	---	---	---	0.1 0.1	5 7	0.1 0.1	5 7	0.1 0.1
Wibaux	1.4 (1.3)	0.3	---	---	0.1 7	0.1	0.1 7	0.1 7	0.1 7
SUBTOTAL	70.2 (65.8)	0.3	3.8	0.6	51.7 74	0.3	0.3 < 1	0.3 < 1	0.3 < 1
STATE TOTAL	2643.0 (346.6)	979.7 (346.6)	7989.3	10.2	720.5 341.2	27	343.5 343.5	13 13	303.6 303.6

1/ Total irrigated land acreage by county includes waterspreading acreage in parentheses.

TABLE V-a--OFF-FARM SYSTEMS TREATMENT OPPORTUNITIES BY YEAR 2000

SUBBASIN County	Total ¹ Irrig. Land Storage acres)	Supply			Conveyance Systems			Return Systems		
		Potential Reservoir Storage	Diversions, Pumping and Ground Water (1,000 ac.-ft.)	Supply Management	Canal Consolidation (1,000 feet)	Canal Lining and Piping (1,000 ft.)	Irrigation Structures (Number)	Waterways (1,000 feet)	Drains (1,000 feet)	Main feet)
<u>UPPER COLUMBIA</u>										
Deer Lodge	13.7	10.4	---	---	30.0	10.0	240	---	---	30.0
Flathead	28.0	---	2.5	---	---	5.0	5	---	---	---
Granite	36.6	---	---	---	250.0	50.0	100	---	---	25.0
Lake	110.3	25.0	68.0	---	---	85.0	3700	---	---	690.0
Lewis & Clark	2.1	---	---	---	7.5	---	40	---	---	1.4
Lincoln	10.4	1.5	---	1.0	---	10.0	65	---	---	30.0
Mineral	1.4	---	---	---	---	---	10	---	---	2.0
Missoula	35.0	---	5.0	---	---	25.0	5	---	---	40.0
Powell	69.4	20.0	20.0	---	500.0	50.0	1000	---	---	250.0
Ravalli	106.8	50.0	---	---	1300.0	750.0	500	---	---	200.0
Sanders	22.6	3.0	2.0	---	---	90.0	360	---	---	250.0
Silver Bow	2.4	---	---	---	---	---	---	---	---	---
SUBTOTAL	438.7	109.9	97.5	1.0	2087.5	1075.0	6025	---	1518.4	
<u>UPPER MISSOURI</u>										
Beaverhead	329.0	150.0	15.0	5.0	450.0	300.0	400	---	---	185.0
Blaine	70.0	10.5	6.0	---	---	121.0	780	---	---	370.0
Broadwater	49.7	2.0	17.0	0.7	53.0	12.0	400	---	---	---

TABLE V-a--OFF-FARM SYSTEMS TREATMENT OPPORTUNITIES BY YEAR 2000 (continued)

SUBBASIN County	Total 1/ (1,000 acres)	Supply			Conveyance Systems			Return Systems			
		Irrig. (5.9)	Potential Land (2.3)	Diversions, Pumping and Storage (1,000 acres)	Supply Water (1,000 ac.-ft.)	Management (1,000 ft.)	Canal Consolidation (1,000 feet)	Canal Lining and Piping (1,000 ft.)	Irrigation Structures (Number)	Drains (1,000 feet)	Main Waterways
Cascade	46.0	---	---	---	---	---	113.2	164.4	210	---	---
Chouteau	(7.1)	2.2	6.8	---	---	---	2.4	50	50	---	16.6
Daniels	3.3	0.3	---	---	---	---	10.0	5	5	---	---
Deer Lodge	(2.3)	8.6	---	---	---	20.0	5.0	140	---	20.0	---
Fergus	(3.5)	4.0	7.0	2.0	---	31.0	100.0	100	100	1.0	20.0
Gallatin	93.0	100.0	14.0	---	2413.0	241.0	---	---	---	1000.0	---
Garfield	(12.0)	13.4	---	---	---	---	---	10	10	---	---
Glacier	(25.2)	26.0	---	---	105.0	634.0	1071	111.0	111.0	48.0	---
Golden Valley	(8.2)	8.6	3.3	---	50.0	224.0	200	3.2	3.2	32.0	---
Hill	(1.5)	19.1	21.0	---	10.0	30.0	50	50	50	---	100.0
Jefferson	(9.3)	27.0	13.0	---	500.0	200.0	2000	2000	2000	---	86.0
Judith Basin	(2.5)	11.5	12.0	3.0	3.0	---	60.0	30	30	---	40.0
Lewis & Clark	(41.5)	---	---	---	150.0	600.0	760	760	760	---	39.9
Liberty	(3.1)	6.4	1.8	1.4	0.6	10.0	7.0	20	20	3.0	10.0
Madison	(140.5)	54.0	20.0	10.0	708.0	350.0	1400	1400	1400	---	500.0
McCone	(8.6)	12.9	7.4	5.9	---	43.0	43.0	169	169	10.5	21.0
Meagher	45.1	40.0	5.0	5.0	---	63.0	25.0	190	190	---	2.0
Musselshell	12.1	2.7	---	---	10.0	348.0	200	9.0	9.0	90.0	---
Petroleum	(4.0)	10.0	9.0	1.0	---	80.0	25	25	25	10.0	---

TABLE V-a--OFF-FARM SYSTEMS TREATMENT OPPORTUNITIES BY YEAR 2000 (Continued)

SUBBASIN County	Total	Supply			Conveyance Systems			Return Systems		
		Potential Irrig. Land (1,000 acres)	Diversion, Pumping and Ground Water (1,000 ac.-ft.)	Supply Management (1,000 ft.)	Canal Consolidation (1,000 feet)	Canal Lining and Piping (1,000 ft.)	Irrigation Structures (Number)	Waterways (1,000 feet)	Main Drains (1,000 feet)	
Phillips	60.5 (10.5) 124.6 (44.9) 18.0 (9.0) 5.2 (5.2) 4.6 (18.6) 141.0 (18.6) 7.9 (5.4) 65.0 (25.0) 37.2 (1.2)	12.0 --- 14.0 --- 10.0 --- 1.3 --- --- --- 56.5 --- 3.0 --- 28.0 --- 15.0 ---	12.0 --- 9.0 --- 10.0 --- 0.5 --- --- 18.8 --- 1.5 --- 12.0 --- 2.2 ---	4.0 --- 9.0 --- --- --- 0.5 --- --- 147.8 --- 0.5 --- 5.0 --- 2.2 ---	--- --- --- --- --- 1267.2 --- --- --- 10.0 --- 75 --- 520.0 ---	250.0 --- 792.0 --- 40.0 --- --- --- 1267.2 --- 10.0 --- 520.0 ---	100 --- 2000 --- 60 --- 10 --- --- 2000 --- 75 --- 400 ---	200.0 --- 200.0 --- 350.0 --- 5.0 --- --- 26.4 --- 20.0 --- 100.0 --- 3.5 ---		
SUBTOTAL	1472.5 (188.3);	542.2	203.4	67.3	5412.0	6561.0	12925	302.6	4936.2	
<u>YELLOWSTONE</u>										
Big Horn	64.6 (1.6) 96.4 ---	6.0 ---	2.0 ---	---	330.0 900.0	757.0 1920.0	1200 2000	26.0 18.0	260.0 180.0	
Carbon										
Custer	71.6 (34.6) 21.5 (4.0) 8.9 (8.9) 51.6 25.0	0.2 2.0 14.2 8.5 --- 14.0	4.0 --- --- --- 860.0 ---	1.5 --- --- --- ---	250.0 --- 130.0 --- 8	---	---	---	20.0 ---	
Dawson										
Fallon										
Park										
Powder River	25.9 (21.0);	0.9	44.1	---	---	---	144	54.0	---	

TABLE V-a--OFF-FARM SYSTEMS TREATMENT OPPORTUNITIES BY YEAR 2000 (Continued)

		Supply		Conveyance Systems		Return Systems		
SUBBASIN County		Total 1/	Potential Diversions, Pumping and Ground Water Management	Canal Consolidation (1,000 feet)	Irrigation Lining and Piping (1,000 ft.)	Waterways Structures (Number)	Main Drains (1,000 feet)	
Prairie	acres)	17.2 (7.4) 50.3 (4.0) 42.1 (7.1) 31.2 (0.4) 59.4 (1.4) 20.3 (0.3) 0.7 (0.7) 99.9 (1.1) 661.6 (92.5);	5.5 0.8 2.2 0.7 12.0 0.5 0.1 1.0 89.1 18.5	---	---	541.4 482.0 50.0 468.0 3.0 100.0 --- --- 500.0 4308.0 8598.4	---	5.0 314.9 138.0 64.0 232.0 100.0 ---
Richland								
Rosebud								
Stillwater								
Sweet Grass								
Treasure								
Wibaux								
Yellowstone								
SUBTOTAL								
LITTLE MISSOURI								
Carter		66.9 (62.9);	2.0	28.0	---	---	7.6	
Fallon		1.9 (1.6);	---	1.5	---	2	12.9	
Wibaux		1.4 (1.3);	0.3	2.1	---	---	4.0	
SUBTOTAL		70.2 (65.8);	2.3	31.6	---	2	16.9	
STATE TOTAL		2643.0 (346.6);	711.3	421.6	86.8 11807.5	16234.4	27204 600.8 8576.1	

1/ Total irrigated land acreage by county includes waterspreading acreage in parentheses.

TABLE V-b--ON-FARM SYSTEMS TREATMENT OPPORTUNITIES BY YEAR 2000
(Montana)

<u>SUBBASIN</u>	<u>County</u>	<u>Total^{1/}</u>	<u>Pipelines</u>	<u>Land</u>	<u>Land</u>	<u>Smoothing</u>	<u>Irrigation</u>	<u>Drainage</u>	<u>Automated</u>	<u>Irrigation</u>
			<u>and Canal</u>	<u>Lining</u>	<u>(1,000 feet)</u>	<u>(1,000 acres)</u>	<u>(Number)</u>	<u>Improve-</u>	<u>Surface</u>	<u>Water</u>
				<u>Lining</u>	<u>(1,000 feet)</u>	<u>(1,000 acres)</u>	<u>(Number)</u>	<u>(1,000 acres)</u>	<u>Irrigation</u>	<u>Management</u>
<u>UPPER COLUMBIA</u>										
	Deer Lodge	13.7	120.0	---	0.4	305	2.1	4.0	---	4.5
	Flathead	28.0	20.0	---	0.3	50	2.0	---	---	5.0
	Granite	36.6	615.0	0.3	---	700	2.0	20.0	1.0	23.2
	Lake	110.3	1100.0	1.0	---	1000	15.0	50.0	---	51.0
	Lewis & Clark	2.1	27.0	---	0.1	45	0.1	1.0	---	0.8
	Lincoln	10.4	60.0	---	1.0	130	1.0	3.0	---	3.0
-56-	Mineral	1.4	---	---	---	12	0.1	0.3	---	0.3
	Missoula	35.0	---	---	---	450	2.3	6.0	---	6.0
	Powell	69.4	500.0	---	1.2	2500	0.2	18.0	---	19.0
	Ravalli	106.8	185.0	5.0	5.0	1200	12.5	40.0	---	40.0
	Sanders	22.6	263.5	---	1.0	250	1.0	8.5	---	8.5
	Silver Bow	2.4	6.8	---	---	---	---	0.2	---	0.3
	SUBTOTAL	438.7	2897.3	6.3	9.0	6642	38.3	151.0	1.0	161.6
	<u>UPPER MISSOURI</u>									
	Beaverhead	329.0	520.0	2.0	5.0	4000	5.0	100.0	10.0	252.6
	Blaine	70.0	528.0	10.0	---	21000	25.0	15.0	4.0	25.0
	Broadwater	49.7	330.0	3.0	0.5	1600	2.0	20.0	5.0	23.8

TABLE V-b--ON-FARM SYSTEMS TREATMENT OPPORTUNITIES BY YEAR 2000 (Montana) (Continued)

SUBBASIN County	Total ^{1/}	Pipelines and Canal	Land Lining (1,000 acres) feet)	Land (1,000 acres)	Leveling (1,000 acres)	Smoothing (1,000 acres)	Irrigation Structures (Number acres)	Drainage Improvement (1,000 acres)	Automated Sprinkler Irrigation -(1,000 acres)	Irrigation Water Management
Cascade	46.0 (7.1)	217.6	3.4	---	340	5.7	2.0	0.5	28.5	
Chouteau	13.1 (5.9)	12.9	1.0	---	587	4.4	3.2	0.8	3.5	
Daniels	3.3 (2.3)	8.0	0.1	---	80	0.1	0.1	---	0.5	
Deer Lodge	8.6	30.0	---	---	195	---	1.0	---	1.2	
Fergus	18.5 (3.5)	60.0	3.0	0.2	1000	1.0	4.0	2.0	5.0	
Gallatin	93.0	480.0	1.0	4.0	1000	10.0	30.0	---	48.0	
Garfield	13.4 (12.0)	5.0	---	---	50	0.1	---	---	1.0	
Glacier	25.2 (8.2)	40.0	7.2	4.0	800	1.7	4.0	---	9.0	
Golden Valley	8.6 (1.5)	98.0	1.0	0.6	600	0.8	0.6	1.5	4.6	
Hill	19.1 (9.3)	62.5	3.0	3.0	1000	1.0	5.0	1.0	5.9	
Jefferson	27.0	350.0	0.4	1.5	900	---	22.0	---	22.2	
Judith Basin	11.5 (2.5)	50.0	3.0	0.2	120	1.0	3.0	---	5.0	
Lewis & Clark	41.5	900.0	---	1.0	850	1.5	33.3	---	35.2	
Liberty	6.4 (3.1)	10.0	1.0	0.5	200	0.1	0.5	---	2.2	
Madison	140.5	1400.0	5.0	5.0	5580	15.5	70.0	2.0	99.3	
McCone	12.9 (8.6)	346.0	5.4	5.0	550	5.9	5.0	5.0	5.9	
Meagher	45.1	78.0	0.8	10.0	600	---	15.0	5.0	16.6	
Musselshell	12.1 (0.5)	180.0	1.0	0.7	1000	0.6	0.7	2.0	7.0	
Petroleum	14.0 (4.0)	50.0	2.0	1.0	400	4.0	---	---	4.0	

TABLE V-b--ON-FARM SYSTEMS TREATMENT OPPORTUNITIES BY YEAR 2000 (Montana) (Continued)

Subbasin County	Total ^{1/}	Pipelines and Canal	Land Lining (1,000 feet)	Land Leveling (1,000 acres)	Land Smoothing (1,000 acres)	Irrigation Structures (1,000 acres)	Drainage Improvement	Automated Surface Irrigation	Irrigation Water Management
Phillips	60.5 (10.5)	630.0	15.0	---	1000	15.0	---	2.0	14.0
Pondera	124.6 (44.9)	107.0	20.0	2.0	8000	0.8	4.0	---	20.0
Roosevelt	18.0 (9.0)	188.0	2.0	0.2	700	4.0	2.0	1.0	3.5
Sheridan	5.2 (5.2)	---	---	---	50	0.5	0.4	1.0	0.4
Silver Bow	4.6 (141.0 (18.6))	13.2	---	---	---	---	0.5	---	0.5
Teton	528.0 (7.9 (5.4))	4.4	88.1	1500	65.2	6.1	5.6	75.0	
Toole	4.0 (65.0 (25.0))	0.5	1.0	50	2.0	1.5	0.5	2.0	
Valley	380.0 (37.2 (1.2))	5.0	---	1250	10.0	4.0	2.0	16.0	
Wheatland	480.0 (1472.5 (188.3))	4.5	3.0	3500	0.5	12.0	6.0	25.8	
SUBTOTAL	1472.5 (188.3)	8086.2	104.7	136.5	58502	183.4	364.9	56.9	763.2
<hr/>									
YELLOWSTONE									
Big Horn	64.6 (1.6)	705.0	13.0	---	7000	10.0	4.0	15.0	30.0
Carbon	96.4	1200.0	9.0	1.0	8000	14.0	15.0	10.0	45.0
Custer	71.6 (34.6)	247.5	7.5	3.2	5000	27.1	5.0	10.0	10.0
Dawson	21.5 (4.0)	125.0	0.8	---	2500	10.6	1.3	7.0	10.0
Fallon	8.9 (8.9)	146.2	1.7	0.9	164	1.7	1.6	3.4	1.6
Park	51.6	750.0	1.0	2.5	2000	---	25.0	2.5	35.0
Powder River	25.9 (21.0)	18.5	3.1	2.5	482	2.8	5.0	5.0	6.3

TABLE V-b--ON-FARM SYSTEMS TREATMENT OPPORTUNITIES BY YEAR 2000 (Montana) (Continued)

TABLE VI-a--PRESENT WATER BUDGET 1/

SUBBASIN County	Total Irrig. Land (1,000 acres)	Gross Diversion	Crop Consumptive Use	Other Use	Total Depletions (1,000 ac.-ft.)	Return Flows
<u>UPPER COLUMBIA</u>						
Deer Lodge	13.7	46.9	9.8	2.0	11.8	35.1
Flathead	28.0	63.4	32.9	8.0	40.9	22.5
Granite	36.6	139.3	32.9	8.0	40.9	98.4
Lake	110.3	296.7	75.7	18.0	93.7	203.0
Lewis & Clark	2.1	9.0	1.9	0.5	2.4	6.6
Lincoln (subsurface)	7.4	30.2	9.1	2.3	11.4	18.8
Mineral	3.0	4.0	4.0	---	4.0	---
Missoula	1.4	3.9	1.6	0.4	2.0	1.9
Powell	35.0	135.7	40.4	10.0	50.4	85.3
Ravalli	69.4	253.4	53.2	13.0	66.2	187.2
Sanders	106.8	449.6	123.8	49.0	172.8	276.8
Silver Bow	22.6	99.8	23.3	5.8	29.1	70.7
SUBTOTAL	438.7	1538.6	410.8	117.6	58.4	1010.2
<u>UPPER MISSOURI</u>						
Beaverhead	329.0	1712.0	323.6	80.5	404.1	1307.9
Blaine	70.0	416.7	100.0	21.4	121.4	295.3
Broadwater	49.7	305.0	60.3	16.0	76.3	228.7

TABLE VI-a--PRESENT WATER BUDGET 1/
(Continued)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Gross Diversion -	Crop Consumptive Use	Other Depletions -	Total (1,000 ac.-ft.)	Return Depletions	Return Flows
Cascade	38.9	214.8	53.7	16.0	69.7	145.1	
Chouteau	(7.1)	(12.5)	(5.0)	---	(5.0)	(7.5)	
Daniels	(5.9)	(7.0)	(7.4)	5.2	12.6	20.4	
Deer Lodge	(1.0)	(5.0)	(3.0)	---	(3.0)	(4.5)	
(2.3)	(2.6)	(1.3)	0.5	1.8	3.2		
Deer Lodge	8.6	45.5	(1.5)	---	(1.5)	(1.1)	
Fergus	15.0	78.1	16.0	8.0	24.0	54.1	
Gallatin	(3.5)	(3.3)	(2.0)	---	(2.0)	(1.3)	
Gallatin	93.0	373.1	78.3	19.0	97.3	275.8	
Garfield	1.4	6.6	2.5	0.5	3.0	3.6	
Glacier	(12.0)	(18.2)	(9.0)	---	(9.0)	(9.2)	
Golden Valley	(17.0)	(65.1)	10.9	6.5	17.4	47.7	
Hill	(8.2)	(6.2)	(2.5)	---	(2.5)	(3.7)	
Hill	7.1	56.2	9.6	2.4	12.0	44.2	
Jefferson	(1.5)	(1.2)	(0.5)	---	(0.5)	(0.7)	
Jefferson	9.8	44.5	10.7	6.5	17.2	27.3	
Jefferson	(9.3)	(11.6)	(2.1)	---	(2.1)	(9.5)	
Judith Basin	27.0	131.1	27.5	6.8	34.3	96.8	
Lewis & Clark	9.0	57.0	7.5	6.0	13.5	43.5	
Liberty	(2.5)	(2.8)	(1.6)	---	(1.6)	(1.2)	
Madison	41.5	260.0	58.1	14.5	72.6	187.4	
McCone	9.0	57.0	7.5	6.0	13.5	43.5	
Meagher	(3.3)	20.9	4.2	1.1	5.3	15.6	
Musselshell	(3.1)	(3.8)	(1.5)	---	(1.5)	(2.3)	
Petroleum	140.5	881.0	144.3	38.0	182.3	698.7	

TABLE VI-a--PRESENT WATER BUDGET ^{1/} (Continued)

SUBBASIN County	Total (1,000 acres)	Irrig. Land (1,000 acres)	Gross Diversion -	Crop Use -	Consumptive Use -	Other Depletions -	Total Depletions -	Return Flows -
					(1,000 ac.-ft.)			
Phillips	50.0	295.5	62.0	20.0	82.0		213.5	
	(10.5)	(11.7)	(6.8)		(6.8)		(4.9)	
Pondera	79.7	229.7	56.2	5.5	61.7		168.0	
	(44.9)	(55.0)	(22.0)		(22.0)		(33.0)	
Roosevelt	9.0	61.3	12.9	5.0	17.9		43.4	
	(9.0)	(10.0)	(5.8)		(5.8)		(4.2)	
Sheridan	0	---	---	---	---		---	
	(5.2)	(5.7)	(3.3)		(3.3)		(2.4)	
Silver Bow	4.6	13.7	3.4	0.9	4.3		9.4	
Teton	122.4	688.4	132.5	27.5	160.0		528.4	
	(18.6)	(17.5)	(7.0)		(7.0)		(10.5)	
Toole	2.5	6.6	1.6	1.0	2.6		4.0	
	(5.4)	(6.8)	(2.7)		(2.7)		(4.1)	
Valley	40.0	202.9	48.1	18.0	66.1		136.8	
	(25.0)	(27.8)	(16.2)		(16.2)		(11.6)	
Wheatland	36.0	252.8	36.4	9.1	45.5		207.3	
	(1.2)	(1.0)	(0.4)		(0.4)		(0.6)	
SUBTOTAL	1284.2 (188.3)	6929.4 (219.5)	1358.2 (101.2)	367.4 ---	1725.6 (101.2)		5203.8 (118.3)	
<u>YELLOWSTONE</u>								
Big Horn	63.0	421.4	88.5	22.1	110.6		310.8	
	(1.6)	(1.3)	(0.5)		(0.5)		(0.8)	
Carbon	96.4	843.5	135.0	40.5	175.5		668.0	
Custer	37.0	201.1	55.4	14.0	69.4		131.7	
	(34.6)	(36.4)	(22.5)		(22.5)		(13.9)	
Dawson	17.5	88.1	23.8	6.0	29.8		58.3	
	(4.0)	(4.2)	(2.6)		(2.6)		(1.6)	
Fallon	0	---	---	---	---		---	
	(8.9)	(9.6)	(5.9)		(5.9)		(3.7)	
Park	51.6	355.7	58.4	16.0	74.4		281.3	
Powder River	4.9	9.8	4.6	1.0	5.6		4.2	
	(21.0)	(23.3)	(12.6)		(12.6)		(10.7)	

TABLE VI-a--PRESENT WATER BUDGET ^{1/} (Continued)

SUBBASIN County	Total (1,000 acres)	Irrig. Land (1,000 acres)	Gross Diversion	Crop Consumptive Use	Other	Total Depletions	Depletions (1,000 ac.-ft.)	Return Flows
Prairie	9.8 (7.4)	63.4 (8.5)	13.1 (4.9)	4.0 --	17.1 (4.9)	46.3 (3.6)		
Richland	46.3 (4.0)	355.8 (42.0)	58.1 (2.6)	12.0 --	70.1 (2.6)	285.7 (1.6)		
Rosebud	35.0 (7.1)	236.0 (5.7)	53.1 (2.3)	13.3 --	66.4 (2.3)	169.6 (3.4)		
Stillwater	30.8 (0.4)	243.0 (0.4)	43.7 (0.2)	13.0 --	56.7 (0.2)	186.3 (0.2)		
Sweet Grass	58.0 (1.4)	500.0 (1.1)	74.0 (0.5)	22.2 --	96.2 (0.5)	403.8 (0.6)		
Treasure	20.0 (0.3)	132.2 (0.3)	30.4 (0.1)	7.6 --	38.0 (0.1)	94.2 (0.2)		
Wibaux	0 (0.7)	---	---	---	---	---		
Yellowstone	98.8 (1.1)	660.0 (1.0)	151.8 (0.4)	38.0 --	189.8 (0.4)	470.2 (0.6)		
SUBTOTAL	569.1 (92.5)	4110.0 (96.8)	789.9 (55.5)	209.7 --	999.6 (55.5)	3170.4 (41.3)		
<u>LITTLE MISSOURI</u>								
Carter	4.0 (62.9)	12.0 (80.3)	5.2 (47.0)	1.8 --	7.0 (47.0)	5.0 (33.3)		
Fallon	0.3 (1.6)	1.0 (1.7)	0.5 (1.0)	0.1 --	0.6 (1.0)	0.4 (0.7)		
Wibaux	0.1 (1.3)	0.3 (1.3)	0.1 (0.7)	---	0.1 (0.7)	0.2 (0.6)		
SUBTOTAL	4.4 (65.8)	13.3 (83.3)	5.8 (48.7)	1.9 --	7.7 (48.7)	5.6 (34.6)		
STATE TOTAL	2296.4 (346.6)	12591.3 (399.6)	2564.7 (205.4)	696.6 --	3261.3 (205.4)	9330.0 (194.2)		

^{1/} Watershed acreage and data in parentheses.

TABLE VII-b--YEAR 2000 WATER BUDGET 1/
(Montana)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Gross Diversion -	Crop Consumptive Use	Other Depletions -	Total Depletions - (1,000 ac.-ft.)	Return Flows
<u>UPPER COLUMBIA</u>						
Deer Lodge	13.7	42.1	11.9	3.0	14.9	27.2
Flathead	28.0	65.4	36.4	8.0	44.4	21.0
Granite	36.6	99.8	32.9	8.0	40.9	58.9
Lake	110.3	390.0	120.1	30.0	150.1	239.9
Lewis & Clark	2.1	7.4	1.9	0.5	2.4	5.0
Lincoln (subsurface) Mineral	7.4 3.0 1.4	28.0 4.0 3.9	9.9 4.0 1.8	2.3 ---	12.2 4.0 0.4	15.8 ---
Missoula	35.0	139.4	45.5	11.5	57.0	82.4
Powell	69.4	235.3	65.2	16.0	81.2	154.1
Ravalli	106.8	379.6	143.1	50.0	193.1	186.5
Sanders	22.6	104.8	29.9	7.5	37.4	67.4
Silver Bow	2.4	6.7	2.3	0.6	2.9	3.8
SUBTOTAL	438.7	1506.4	504.9	137.8	642.7	863.7
<u>UPPER MISSOURI</u>						
Beaverhead	329.0	1134.5	361.9	95.0	456.9	677.6
Blaine	70.0	263.0	105.7	14.0	119.7	143.3
Broadwater	49.7	169.2	64.6	10.0	74.6	94.6

TABLE VI-b--YEAR 2000 WATER BUDGET (Montana) ^{1/} (Continued)

SUBBASIN County	Total (1,000 acres)	Irrig. Land (1,000 acres)	Gross Diversion	Crop Consumptive Use	Other Depletions	Total (1,000 ac.-ft.)	Depletions	Total Depletions	Return Flows
Cascade	38.9	109.6	53.7	8.0	61.7	47.9			
Chouteau	(7.1)	(12.5)	(5.0)	---	(5.0)	(7.5)			
Daniels	7.2	29.3	10.9	4.8	15.7	13.6			
Deer Lodge	(5.9)	(7.5)	(3.0)	---	(3.0)	(4.5)			
Fergus	1.0	3.2	1.5	0.5	2.0	1.2			
Gallatin	(2.3)	(2.6)	(1.5)	---	(1.5)	(1.1)			
Garfield	8.6	34.5	7.7	1.5	9.2	25.3			
Glacier	15.0	53.8	19.2	8.0	27.2	26.6			
Golden Valley	(3.5)	(3.3)	(2.0)	---	(2.0)	(1.3)			
Hill	93.0	307.1	99.5	23.0	122.5	184.6			
Jefferson	1.4	5.6	2.5	0.5	3.0	2.6			
Judith Basin	(12.0)	(18.2)	(9.0)	---	(9.0)	(9.2)			
Lewis & Clark	17.0	37.1	14.5	6.0	20.5	16.6			
Liberty	(8.2)	(6.2)	(2.5)	---	(2.5)	(3.7)			
Madison	7.1	30.9	10.7	2.1	12.8	18.1			
MCCone	(1.5)	(1.2)	(0.5)	---	(0.5)	(0.7)			
Meagher	9.8	34.6	14.6	7.2	21.8	12.8			
Musselshell	(9.3)	(11.6)	(2.1)	---	(2.1)	(9.5)			
Petroleum	27.0	95.4	33.2	8.0	41.2	54.2			
W	9.0	28.6	10.0	5.0	15.0	13.6			
W	(2.5)	(2.8)	(1.6)	---	(1.6)	(1.2)			
W	41.5	184.7	58.9	14.5	73.4	111.3			
W	410.5	444.8	157.4	15.7	173.1	271.7			
W	4.3	13.5	6.6	1.6	5.8	8.8			
W	(8.6)	(9.4)	(5.5)	---	(5.5)	(3.9)			
W	45.1	202.0	50.5	8.0	58.5	143.5			
W	11.6	55.7	19.5	3.9	23.4	32.3			
W	(0.5)	(0.5)	(0.2)	---	(0.2)	(0.3)			
W	10.0	40.8	15.3	4.0	19.3	21.5			
W	(4.0)	(4.4)	(2.6)	---	(2.6)	(1.8)			

TABLE VI-b--YEAR 2000 WATER BUDGET (Montana) 1/ (Continued)

<u>SUBBASIN</u>	<u>Total</u>	<u>Gross</u>	<u>Crop</u>	<u>Consumptive</u>	<u>Other</u>	<u>Total</u>	<u>Depletions</u>	<u>Return</u>
<u>County</u>	<u>Irrig.</u>	<u>Diversi-</u>	<u>Use</u>	<u>Use</u>	<u>Depletions</u>	<u>(1,000 ac.-ft.)</u>	<u>Depletions</u>	<u>Flows</u>
Phillips	50.0 (10.5)	178.8 (11.7)	71.5 (6.8)	20.0 ---	91.5 (6.8)	87.3 (4.9)		
Pondera	79.7 (44.9)	191.7 (55.0)	68.5 (22.0)	4.5 ---	73.0 (22.0)	118.7 (33.0)		
Roosevelt	9.0 (9.0)	33.8 (10.0)	13.5 (5.8)	5.0 ---	18.5 (5.8)	15.3 (4.2)		
Sheridan	0 ---	---	---	---	---	---		
Silver Bow	4.6 ---	5.2 (5.7)	3.6 (3.6)	0.9 ---	3.6 (4.5)	2.1 (2.1)		
Teton	122.4 (18.6)	383.5 (17.5)	137.1 (7.0)	21.5 ---	158.6 (7.0)	224.9 (10.5)		
Toole	2.5 (5.4)	5.9 (6.8)	2.9 (2.7)	0.8 ---	3.7 (2.7)	2.2 (4.1)		
-66- Valley	40.0 (25.0)	145.0 (27.8)	58.0 (16.2)	18.0 ---	76.0 (16.2)	69.0 (11.6)		
Wheatland	36.0 (1.2)	162.7 (1.0)	40.7 (0.4)	8.1 ---	48.8 (0.4)	113.9 (0.6)		
SUBTOTAL	1284.2 (188.3)	4407.6 (219.5)	1518.9 (101.5)	321.2 ---	1840.1 (101.5)	2567.5 (118.0)		
YELLOWSTONE								
Big Horn	63.0 (1.6)	248.8 (1.3)	91.4 (0.5)	18.3 ---	109.7 (0.5)	139.1 (0.8)		
Carbon	96.4	395.0	135.0	27.0	162.0	233.0		
Custer	37.0 (34.6)	161.9 (36.4)	60.3 (24.2)	14.0 ---	74.3 (24.2)	87.6 (12.2)		
Dawson	17.5 (4.0)	82.6 (4.2)	27.3 (2.8)	6.0 ---	33.3 (2.8)	49.3 (1.4)		
Fallon	0 (8.9)	---	---	---	---	---		
Park	51.6	195.3	69.1	17.0	86.1	109.2		
Powder River	4.9 (21.0)	15.3 (23.3)	7.5 (14.7)	1.5 ---	9.0 (14.7)	6.3 (8.6)		

TABLE VI-b--YEAR 2000 WATER BUDGET (Montana)^{1/} (Continued)

<u>SUBBASIN</u>	<u>County</u>	Total	Gross Diversion	Crop Consumptive Use	Other	Total	Depletions	Return Flows
		(1,000 acres)	-	-	(1,000 ac. - ft.)	-	-	-
Prairie		9.8 (7.4)	26.8 (8.5)	14.5 (4.9)	2.0	16.5 (4.9)	10.3 (3.6)	
Richland		46.3 (4.0)	195.4 (4.2)	60.2 (2.8)	12.0 ---	72.2 (2.8)	123.2 (1.4)	
Rosebud		35.0 (7.1)	146.8 (5.7)	53.9 (2.3)	10.8 ---	64.7 (2.3)	82.1 (3.4)	
Stillwater		30.8 (0.4)	125.0 (0.4)	43.7 (0.2)	8.8 ---	52.5 (0.2)	72.5 (0.2)	
Sweet Grass		58.0 (1.4)	237.2 (1.1)	79.5 (0.5)	15.9 ---	95.4 (0.5)	141.8 (0.6)	
Treasure		20.0 (0.3)	81.8 (0.3)	30.6 (0.1)	6.1 ---	36.7 (0.1)	45.1 (0.2)	
Wibaux		0 (0.7)	---	---	---	---	---	
Yellowstone		98.8 (1.1)	404.8 (0.9)	152.2 (0.4)	30.4 ---	(0.4) (0.4)	182.6 (0.5)	222.2 (0.5)
SUBTOTAL		569.1 (92.5)	2316.7 (96.7)	825.2 (60.2)	169.8 ---	995.0 (60.2)	1321.7 (36.5)	
<u>LITTLE MISSOURI</u>								
Carter		4.0 (62.9)	12.8 (80.3)	6.0 (50.6)	1.8 ---	7.8 (50.6)	5.0 (29.7)	
Fallon		0.3 (1.6)	1.0 (1.7)	0.5 (1.1)	0.1 ---	0.6 (1.1)	0.4 (0.6)	
Wibaux		0.1 (1.3)	0.3 (1.3)	0.1 (0.7)	---	0.1 (0.7)	0.2 (0.6)	
SUBTOTAL		4.4 (65.8)	14.1 (83.3)	6.6 (52.4)	1.9 ---	8.5 (52.4)	5.6 (30.9)	
STATE TOTAL		2296.4 (346.6)	8244.8 (399.5)	2855.6 (214.1)	630.7 ---	3486.3 (214.1)	4758.5 (185.4)	

^{1/} Waterspreading acreage and data in parentheses.

TABLE VII--SALT BUDGET 1/
(Montana)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Present			Year 2000			Return : Diverted (1,000 Tons)	Reduction
		Diverted	Pickup	Return	Diverted	Pickup	Return		
<u>UPPER COLUMBIA</u>									
Deer Lodge	13.7	7.0	3.0	10.0	6.3	1.5	7.8	1.5	
Flathead	28.0	9.5	-3.1	6.4	9.8	-3.7	6.1	0.6	
Granite	36.6	13.9	12.1	26.0	10.0	5.2	15.2	6.5	
Lake	110.3	29.7	26.3	56.0	39.0	28.0	67.0	-1.7	
Lewis & Clark	2.1	1.4	0.5	1.9	1.1	0.4	1.5	0.1	
Lincoln	7.4	4.5	0.7	5.2	4.2	---	4.2	0.7	
Mineral	3.0	0.8	-0.3	0.5	0.8	-0.4	0.4	0.1	
Missoula	1.4	35.0	33.9	-1.1	32.8	35.1	-6.6	28.5	5.5
Powell	69.4	58.3	-3.1	55.2	53.2	-7.7	45.5	4.6	
Ravalli	106.8	36.0	24.4	60.4	30.4	7.7	38.1	16.7	
Sanders	22.6	12.0	8.0	20.0	12.6	7.2	19.8	0.8	
Silver Bow	2.4	1.4	-0.3	1.1	1.4	-0.3	1.1	---	
SUBTOTAL	438.7	208.4	67.1	275.5	203.9	31.3	235.2	35.8	
<u>UPPER MISSOURI</u>									
Beaverhead	329.0	342.4	29.6	372.0	226.9	-37.2	189.7	66.8	
Blaine	70.0	166.7	231.4	398.1	104.5	111.9	216.4	119.5	
Broadwater	49.7	76.3	5.8	82.1	42.3	0.1	42.4	5.7	

TABLE VII--SALT BUDGET $\frac{1}{}$ (continued)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Present			Year 2000			Reduction
		Diverted	Pickup	Return (1,000 Tons)	Diverted	Pickup	Return	
Cascade	38.9 (7.1)	54.5 (3.1)	17.6 (0.4)	72.1 (3.5)	27.8 (3.1)	-4.2 (0.4)	23.6 (3.5)	21.8
Chouteau	7.2 (5.9)	9.9 (2.3)	-1.4 ---	8.5 (2.3)	8.7 (2.3)	-2.1 ---	6.6 (2.3)	0.7
Daniels	1.0 (2.3)	2.0 (1.0)	0.6 (-0.1)	2.6 (0.9)	1.3 (1.0)	-0.4 (-0.1)	0.9 (0.9)	1.0
Deer Lodge	8.6 ...	6.8 ...	3.2 ...	10.0 ...	5.4 ...	1.7 ...	7.1 ...	1.5
Fergus	15.0 (3.5)	11.7 (0.5)	1.4 (-0.1)	13.1 (0.4)	8.1 ...	-1.9 (-0.1)	6.2 ...	3.3
Gallatin	93.0 ...	74.6 ...	134.0 ...	208.6 ...	61.4 ...	84.6 ...	146.0 ...	49.4
Garfield	1.4 (12.0)	3.3 (9.1)	---	3.3 (7.7)	2.8 (9.1)	-0.5 (-1.4)	2.3 ...	0.5
Glacier	17.0 (8.2)	13.0 (1.2)	0.8 ---	13.8 (1.2)	7.4 ...	-1.1 ---	6.3 ...	1.9
Golden Valley	7.5 (1.5)	56.2 (1.2)	16.5 ---	72.7 (1.2)	30.9 ...	0.1 ---	31.0 ...	16.4
Hill	9.8 (29.3)	16.4 ...	11.4 ---	27.8 ...	12.8 ...	-0.2 ---	12.6 ...	11.6
Jefferson	27.0 ...	26.2 ...	8.7 ...	34.9 ...	19.1 ...	-0.2 ---	18.9 ...	8.9
Judith Basin	9.0 (2.5)	11.4 ...	1.6 ---	13.0 ...	5.7 ...	0.1 ---	5.8 ...	1.5
Lewis & Clark	41.5 ...	59.8 ...	8.5 ...	68.3 ...	(0.6) ...	(0.6) ...	(0.6) ...	11.3
Liberty	3.3 (3.1)	5.2 ...	-0.7 ...	4.5 ...	3.6 ...	-1.0 ...	2.6 ...	0.3
Madison	140.5 ...	264.3 ...	74.6 ...	338.9 ...	133.2 ...	-9.9 ...	123.3 ...	84.5
McCone	4.3 (8.6)	6.8 ...	---	6.8 ...	6.6 ...	-1.4 ...	5.2 ...	1.4
Meagher	45.1 ...	58.8 ...	4.7 ...	63.5 ...	40.4 ...	1.1 ...	41.5 ...	3.6
Musselshell	11.6 (0.5)	106.0 ...	33.1 ...	139.1 ...	55.6 ...	0.6 ...	56.2 ...	32.5
Petroleum	10.0 (4.0)	17.8 ...	14.0 ...	31.8 ...	12.2 ...	3.5 ...	15.7 ...	10.5

TABLE VII-SALT BUDGET 1/ (Continued)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Present			Year 2000		
		Diverted	Pickup	Return	Diverted	Pickup	Return
					(1,000 Tons)	(1,000 Tons)	(1,000 Tons)
Phillips	50.0 (10.5)	147 / (5.8)	48.9 (-0.7)	196.6 (5.1)	89.4 (5.8)	-16.1 (-0.7)	73.3 (5.1)
Pondera	79.7 (44.9)	45.9 (13.8)	11.7 (0.1)	57.6 (13.9)	38.3 (13.8)	3.2 (0.1)	41.5 (13.9)
Roosevelt	9.0 (9.0)	36.8 (4.0)	1.3 (-0.8)	38.1 (3.2)	20.3 (4.0)	-8.6 (-0.8)	11.7 (3.2)
Sheridan	0 (5.2)	---	---	---	---	---	---
Silver Bow	4.6 122.4 (18.6)	(3.3) 172.1 (4.4)	0.6 (0.5)	(6.6) 252.9 (4.9)	(3.3) 96.3 (4.4)	(2.5) 3.5 (0.5)	(5.8) 99.8 (4.9)
Teton	2.5 (5.4)	1.3 (1.3)	0.2 (0.4)	1.5 (1.7)	1.1 (1.7)	-0.3 (1.3)	0.8 (0.4)
Toole	40.0 (25.0)	142.1 (13.9)	11.1 (-0.5)	153.1 (13.4)	101.5 (13.9)	-18.9 (-0.5)	82.6 (13.4)
Valley	36.0 (1.2)	101.1 (0.4)	56.8 (-0.2)	157.9 (0.2)	65.1 (0.4)	25.3 (-0.2)	90.4 (0.2)
Wheatland	1284.2 (188.3)	2039.8 (76.7)	806.7 (1.1)	2846.5 (77.8)	1274.0 (76.7)	127.5 (0.3)	1403.5 (77.0)
SUBTOTAL							677.2 (0.8)
YELLOWSTONE							
Big Horn	63.0 (1.6)	379.3 (1.2)	249.8 (0.5)	629.1 (1.7)	225.1 (1.2)	67.8 (0.5)	292.9 (1.7)
Carbon	96.4 37.0	219.4 (10.9)	186.8 (-1.5)	406.2 (9.4)	102.8 (10.9)	48.2 (-1.5)	151.0 (9.4)
Custer	(34.6)	52.8 (1.3)	43.0 (-0.3)	95.8 (1.0)	50.8 (1.3)	32.3 (-0.3)	83.1 (1.0)
Dawson	(4.0)	---	---	---	---	---	---
Fallon	0 (8.9)	(4.8) 71.1	(-0.8) 7.8	(4.0) 78.9	(4.8) 39.0	(-1.2) -8.6	(3.6) 30.4
Park	51.6 4.9	4.9 (9.3)	-0.2 (-1.7)	4.7 (7.6)	7.5 (9.3)	-1.1 (-1.7)	6.4 (7.6)
Powder River	(21.0)						0.9 ---

TABLE VII--SALT BUDGET 1/ (Continued)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Present			Year 2000		
		Diverted	Pickup	Return	Diverted (1,000 Tons)	Pickup	Return
Prairie	9.8 (7.4)	38.1 (5.1)	18.3 (-1.0)	56.4 (4.1)	16.2 (5.1)	-5.7 (-1.0)	10.5 (4.1)
Richland	46.3 (4.0)	277.5 (1.3)	93.2 (-0.3)	370.7 (1.0)	154.1 (1.3)	33.1 (-0.3)	187.2 (1.0)
Rosebud	35.0 (7.1)	129.8 (3.1)	33.3 (0.2)	163.1 (3.3)	81.2 (3.1)	1.6 (0.2)	82.8 (3.3)
Stillwater	30.8 (0.4)	41.1 (0.1)	29.4 (0.1)	70.5 (0.1)	21.2 (0.1)	7.6 (0.1)	28.8 (0.1)
Sweet Grass	58.0 (1.4)	90.0 (0.2)	70.0 (0.2)	160.0 (0.2)	42.8 (0.2)	15.9 (0.2)	58.7 (0.2)
Treasure	20.0 (0.3)	66.1 (0.2)	16.6 (0.2)	82.7 (0.2)	41.0 (0.2)	0.5 (0.2)	41.5 (0.2)
Wibaux	0 (0.7)	-- (0.2)	-- (-0.1)	-- (0.1)	-- (0.2)	-- (-0.1)	-- (0.1)
Yellowstone	98.8 (1.1)	237.6 (0.3)	89.3 (0.1)	326.9 (0.4)	145.7 (0.3)	10.0 (0.1)	155.7 (0.4)
SUBTOTAL	569.1 (92.5)	1738.4 (38.0)	833.7 (-4.9)	2572.1 (33.1)	1031.6 (38.0)	177.6 (-5.3)	1209.2 (32.7)
LITTLE MISSOURI							
Carter	4.0 (62.9)	6.0 (40.2)	-0.6 (-2.5)	5.4 (37.7)	6.4 (40.2)	-1.0 (-2.5)	5.4 (37.7)
Fallon	0.3 (1.6)	0.5 (0.9)	-0.1 (-0.1)	0.4 (0.8)	0.5 (0.9)	-0.1 (-0.1)	0.4 (0.8)
Wibaux	0.1 (1.3)	0.3 (0.4)	-0.1 (-0.1)	0.2 (0.3)	0.3 (0.4)	-0.1 (-0.1)	0.2 (0.3)
SUBTOTAL	4.4 (65.8)	6.8 (41.5)	-0.8 (-2.7)	6.0 (38.8)	7.2 (41.5)	-1.2 (-2.7)	6.0 (38.8)
STATE TOTAL	2296.4 (346.6)	3993.4 (156.2)	1706.7 (-6.5)	5700.1 (149.7)	2516.7 (156.2)	337.2 (-7.7)	2853.9 (148.5)
							1369.5 (11.2)

1/ Waterspreading acreage and data in parentheses.

TABLE VIII--IMPACT OF TREATMENT OPPORTUNITIES
(Montana)

SUBBASIN County	Total Irrig. Land (1,000 acres)	Treatment Cost (Dollars per ac.)	Decrease in Salt Pickup (1,000 tons)			
			Increased Supply (\$1,000) (1,000 ac.-ft.)	Seepage Reduction (\$1,000 ac.-ft.)	Diversion Reduction (\$1,000 ac.-ft.)	Decrease in Salt Pickup (1,000 tons)
<u>UPPER COLUMBIA</u>						
Deer Lodge	13.7	3,900	285	10.4	6.8	4.8
Flathead	28.0	300	11	2.5	0.7	+2.0
Granite	36.6	7,100	194	---	34.3	39.5
Lake	110.3	29,500	268	93.0	+42.7	+93.3
Lewis & Clark	2.1	300	143	---	3.4	1.6
Lincoln	10.4	1,500	144	2.5	2.5	2.2
Mineral	1.4	100	72	---	0.1	---
Missoula	35.0	1,200	34	5.0	2.1	+3.7
Powell	69.4	15,700	226	40.0	26.8	18.1
Ravalli	106.8	32,700	306	50.0	87.8	70.0
Sanders	22.6	5,300	235	5.0	+1.8	+5.0
Silver Bow	2.4	100	42	---	0.1	---
SUBTOTAL	438.7	97,700	223	208.4	120.1	32.2
<u>UPPER MISSOURI</u>						
Beaverhead	329.0	53,700	164	170.0	584.2	577.5
Blaine	70.0	18,200	260	16.5	78.3	153.7
Broadwater	49.7	11,100	224	19.7	101.4	135.8

TABLE VIII--IMPACT OF TREATMENT OPPORTUNITIES (Montana) (Continued)

SUBBASIN County	Total ^{1/} Irrig.	Treatment Cost (Dollars per ac.)	Increased Supply (1,000 ac.-ft.)	Seepage Reduction (1,000 ac.-ft.)	Diversions Reduction (1,000 tons)	Decrease in Salt Pickup (1,000 tons)
Cascade	46.0 (7.1)	6,300	137	---	83.6	105.2 21.8
Chouteau	13.1 (5.9)	1,900	145	9.0	3.3	3.7 0.7
Daniels	3.3 (2.3)	400	121	0.3	1.7	1.8 1.0
Deer Lodge	8.6	500	58	---	9.9	11.0 1.5
Fergus	18.5 (3.5)	4,000	216	13.0	18.6	24.3 3.3
Gallatin	93.0 (8.2)	30,700	330	114.0	53.3	66.0 49.4
Garfield	13.4 (12.0)	100	8	---	1.0	1.0 0.5
Glacier	25.2 (8.2)	17,800	706	26.0	7.0	28.0 1.9
Golden Valley	8.6 (1.5)	5,400	628	3.3	20.8	25.3 16.4
Hill	19.1 (9.3)	4,700	246	21.0	5.7	9.9 11.6
Jefferson	27.0	10,000	370	13.0	37.0	35.7 8.9
Judith Basin	11.5 (2.5)	4,500	391	18.0	13.5	28.4 1.5
Lewis & Clark	41.5 (3.1)	13,100	316	---	65.5	75.3 11.3
Liberty	6.4 (3.1)	600	94	3.8	0.7	6.3 0.3
Madison	140.5 (4.0)	45,200	322	84.0	390.7	436.2 84.5
McCone	12.9 (8.6)	5,800	450	13.3	0.9	0.1 1.4
Meagher	45.1	18,100	401	50.0	58.6	92.0 3.6
Musselshell	12.1 (0.5)	9,400	777	2.7	40.2	50.3 32.5
Petroleum	14.0 (4.0)	4,200	300	20.0	14.3	18.5 10.5

TABLE VIII--IMPACT OF TREATMENT OPPORTUNITIES (Montana) (Continued)

<u>SUBBASIN</u>	<u>County</u>	Total ^{1/}	Treatment Cost	Increased Supply	Seepage Reduction	Diversions Reduction	Decrease in Salt Pickup (1,000 tons)
		Irrig. Land (1,000 acres)	(Dollars per ac.)	(1,000 ac.-ft.)	(1,000 ac.)	(1,000 ac.-ft.)	
Phillips		60.5 (10.5) 124.6 (44.9)	13,900	230	28.0	86.3	116.7 65.0
Pondera		14,600		117	23.0	24.6	38.0 8.5
Roosevelt		5,400		300	20.0	24.0	27.5 9.9
Sheridan		300		58	1.8	0.3	---
Silver Bow		4.6		100	22	0.2	---
Teton		50,300		357	75.3	261.1	304.9 77.3
Toole		1,200		152	5.0	1.2	0.7 0.5
Valley		11,300		174	45.0	32.9	57.9 29.9
Wheatland		15,600 (1.2)		420	17.2	77.8	90.1 31.5
SUBTOTAL		1472.5 (188.3)	378,400	257	812.9	2098.6	2521.8 678.0
<u>YELLOWSTONE</u>							
Big Horn		23,200		360	8.0	117.9	172.6 182.0
Carbon		39,400		409	---	313.7	448.5 138.6
Custer		7,100		100	5.7	40.1	39.2 20.4
Dawson		6,500		302	16.2	6.8	5.5 10.7
Fallon		1,200		135	8.5	0.5	---
Park		15,500		300	39.0	148.3	160.4 16.4
Powder River		3,400 (21.0)		131	45.0	0.8	+5.5 0.9

TABLE VIII--IMPACT OF TREATMENT OPPORTUNITIES (Montana) (Continued)

SUBBASIN County	Total Irrig. Land (\$1,000 acres)	Treatment Cost (Dollars per ac.)	Increased Supply - - - (\$1,000 ac.-ft.)	Seepage Reduction - - - (\$1,000 ac.)	Diversion Reduction - - - (\$1,000 tons)	Decrease in Salt Pickup (\$1,000 tons)
Prairie	17.2 (7.4)	15,700 30,000	913 596	5.5 14.0	31.1 39.5	36.6 160.4
Richland	50.3 (4.0)					24.0 60.1
Rosebud	42.1 (7.1)	12,700	302	2.2	65.0	89.2
Stillwater	31.2 (0.4)	14,500	465	0.7	91.3	118.0
Sweet Grass	59.4 (1.4)	25,800	435	17.0	224.5	262.8
Treasure	20.3 (0.3)	8,100	399	0.5	36.4	50.4
Wibaux	0.7 (0.7)	200	286	1.2	---	---
Yellowstone	99.9 (1.1)	38,500	385	1.0	185.3	225.2
SUBTOTAL	661.6 (92.5)	241,800	366	164.5	1301.2	1763.3
LITTLE MISSOURI						656.5
Carter	66.9 (62.9)	8,300	124	30.0	---	0.4
Fallon	1.9 (1.6)	300	158	1.5	---	---
Wibaux	1.4 (1.3)	300	214	2.4	---	---
SUBTOTAL	70.2 (65.8)	8,900	127	33.9	---	+0.8
STATE TOTAL	2643.0 (346.6)	726,800	275	1219.7	3519.9	4316.5
						1370.7

1/ Total irrigated land acreage by county includes waterspreading acreage in parentheses.



